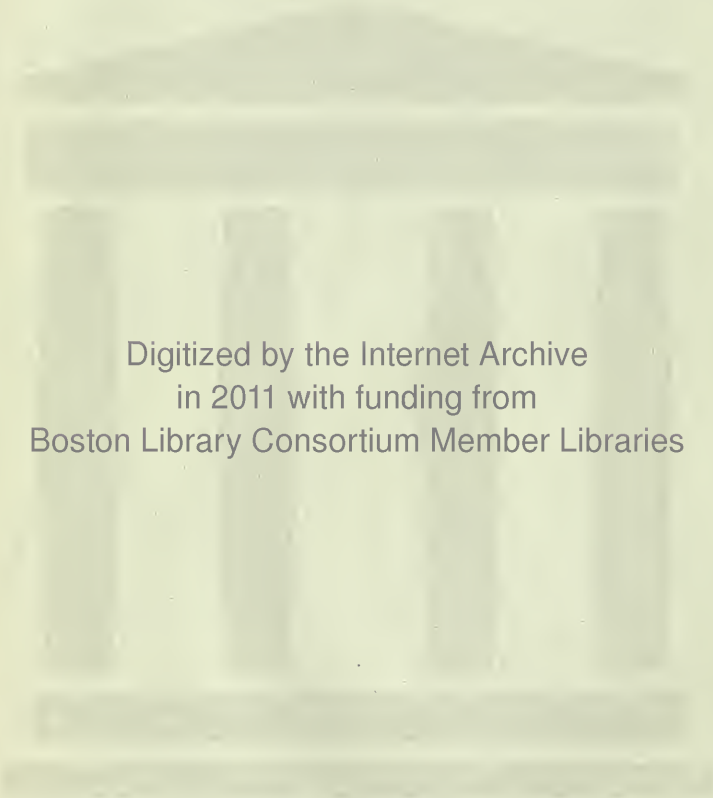

Northeastern College

June 1918

Evening School of Engineering

1918 - 1919

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Home of Northeastern College

Northeastern College

Evening School of Engineering

1918 - 1919

BOSTON, MASSACHUSETTS

Calendar 1918-19

September 9-14
Registration

September 16
Opening of First Term

October 12
Columbus Day (School exercises omitted)

November 28
Thanksgiving Day (School exercises omitted)

December 21
End of First Term

December 23-28 inclusive
Christmas Recess

December 30
Opening of Second Term

January 1
New Year's Day (School exercises omitted)

February 22
Washington's Birthday (School exercises omitted)

April 5
End of Second Term

April 7-11 inclusive
Final examinations

April 12
Close of School

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GENERAL INFORMATION

Many men in various lines of industry feel the need of special instruction in Engineering, either to advance in their normal occupation, or to enable them to change their positions and get into work of an Engineering nature.

To such men the Evening School of Engineering offers a wide variety of regular Engineering Courses, and in addition, special instruction for those who desire it, in Architecture, Drawing and Design. The Engineering Courses require attendance from two to three evenings a week, during a period of four years. While only the fundamental subjects are taken up, the courses compare very favorably with similar courses offered by the good technical schools of the country.

Four-year Engineering Courses

Regular four-year courses, leading to a diploma, are offered in the following branches of Engineering:

I Civil Engineering
II Mechanical Engineering
III Electrical Engineering
IV Chemical Engineering
V Structural Engineering

Special Courses

Special courses in Architecture, Freehand Drawing and Industrial Design, are offered by the School, and will be found described in detail in the latter part of this catalog.

Requirements for Admission

The work carried on in the Engineering Courses assumes that the entering student has had previous training in Elementary Algebra to quadratics, Plane Geometry, and has a good ground-work in English. An entering student should have completed at least the equivalent of from one to two years' work in a good high school. Those who have completed a full high school course should be well fitted to carry on the courses and should derive the maximum benefit from the work.

The men who finished grammar school, but who have not had the requisite previous training in Mathematics and English, can attend the Evening Courses of the Northeastern

Preparatory School, and should be able to get the necessary preparation for entrance to the Engineering School in from one to two years.

There are no entrance examinations for entering students, but each applicant for admission is required to have an interview with the Dean or the Director.

The qualifications of each applicant will be ascertained and he will be advised as to just what work he is qualified to undertake.

Should a student prove to be unable to carry on his studies successfully, he may be required to discontinue any subject in which he is deficient, and complete such preparatory work as is deemed necessary, before being re-admitted to the subject in question.

Tuition Fees

For each of the regular four-year Engineering Courses the tuition fees are as follows:

The first year tuition in any full Course is thirty-five (35) dollars.

This amount, which includes membership in the Association, is payable as follows:

$15.00 upon entering the School
10.00 November 15th
10.00 January 15th

The tuition fee for all years, except the first, is fifty dollars, which includes membership in the Association. This amount is payable as follows:

$20.00 upon entering the School
15.00 November 15th
15.00 January 15th

The tuition fee for special courses will be found on page 44

Refunds

Students who are compelled, for any reason, to leave the School before the end of the school year, shall be charged at the rate of two dollars per week for each week of school attendance, and in addition to this, shall be charged an extra five dollars, over and above this weekly rate. The date of withdrawal of any student shall be the day on which the School receives formal notice of his intentions to leave.

Laboratory Fees

All students taking courses in the Chemical Laboratories are charged a laboratory fee of four dollars. This fee is payable in advance, does not cover breakage or destruction of apparatus, and will not be refunded.

An additional laboratory deposit of four dollars must be made before a desk will be assigned to a student. At the close of the school year the cost of equipment broken by the student or not returnable will be deducted from this amount and the balance refunded. Students failing to check up their desks upon leaving school will be charged one dollar extra.

Transfers

No student is permitted to transfer from one course to another without consulting the Director beforehand and receiving a transfer order, which must be presented at the main office for the proper transfer card.

Reports of Standing

An informal report of the students' standing is issued at the end of the first term, and a formal report, covering the year's work, is issued at the close of each year.

Physical Training

By a special arrangement between the Department of Recreation and Health and the School, it has been made possible for those students who desire it to get the privileges of the gymnasium and natatorium, for special hours, upon the payment of seven dollars and a half, in addition to the tuition. By this means our students may avail themselves of these privileges at a minimum cost.

Positions Held by Graduates

The graduates of the School are in constant demand, and it may be said that those who complete one of the courses successfully can be sure of desirable employment in his chosen line.

Naturally the School does not guarantee to place its graduates in positions. This is not necessary since our graduates have no difficulty in finding places for themselves.

Special Students

A special student may take any subject, upon the approval of the Director, provided he has had the necessary preliminary training.

Scholarships

As an aid to worthy men who desire an education and are unable to pay the tuition fees, a limited number of scholarships has been provided, which will be granted by the Board of Governors, to whom application should be made. Students who can afford to pay are requested not to apply for this privilege.

Diplomas

Upon the satisfactory completion of any of the regular courses, the student is entitled to receive a diploma

Courses of Study

GENERAL STATEMENT.

The schedules of the various courses are given on the following pages. The first-year work of all courses is practically the same, with a few exceptions, which are made because of the need of the student for elementary training in his professional subjects.

The school year comprises twenty-eight weeks of class work, and one week of examinations The twenty-eight weeks are divided into two terms of fourteen weeks each. The subjects in the Course Outlines on the following pages have been arranged by terms. Opposite these subjects will be found the number of periods of forty-five minutes each of class work, recitation, laboratory, or the drawing room. The number in parenthesis, following the subject is the number by which that subject is identified in the descriptive matter under "Subjects of Instruction."

When a student elects a course, he is required to complete all subjects in that course in order to receive a diploma. No subject is to be dropped, or omitted, without the consent of the Director.

I. CIVIL ENGINEERING

The purpose of this course is to give the student an education in those subjects which form the basis of all branches of technical education, and a special training in those subjects comprised under the term "Civil Engineering." It is designed to give the student sound training, both theoretical and practical, in the sciences upon which professional practice is based.

Civil Engineering covers such a broad field that no one can become expert in its whole extent. It includes Topographical Engineering, Municipal Engineering, and Railroad Engineering. It covers land surveying, the construction of sewers, waterworks, roads and streets. All these branches of Engineering rest, however, upon a relatively compact body of principles, and in these principles the students are trained by practice in the class room, drawing room and the field.

The course is designed to prepare the young engineer to take up the work of assisting in the location and construction of steam and electric railways, sewerage and water supply systems.

I. CIVIL ENGINEERING

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (7)	2	Practical Physics (7)	2
Practical Physics Problems (8)	1	Practical Physics Problems (8)	1
Mechanical Drawing (9)	3	Mechanical Drawing (9)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Advanced Mathematics (5)	2	Advanced Mathematics (5)	2
Surveying (10)	4	Surveying (10)	4
Topographical Drawing (11)	2	Topographical Drawing (11)	2
Highway Engineering (12)	1	Highway Engineering (12)	1

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Hydraulics (30)	2	Strength of Materials I (17)	2
Railroad Engineering (13)	2	Railroad Engineering (13)	2
Railroad Engineering Drawing (14)	3	Railroad Engineering Drawing (14)	3

FOURTH YEAR (Omitted 1918-19)

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Strength of Materials II (18)	2	Foundations (29)	1
Elements of Structures (20A)	2	Elements of Structures (20A)	1
Concrete (24)	2	Concrete (24)	2
Engineering Problems (15)	3	Engineering Problems (15)	3
		Materials of Construction (28)	2

II. MECHANICAL ENGINEERING

This course is designed to give a foundation in those fundamental subjects which form the basis for all professional engineering practice, and especially to equip the young engineer with a knowledge of the various phases of Mechanical Engineering. The course embraces instruction by text-book, lecture, and drawing room.

The course affords training in the methods, and gives practice in the process of Construction, which develops in the student the capacity for thinking along mechanical lines, thus enabling him to base all his work upon fundamental principles already learned, rather than upon empirical rules. It is the endeavor to give the student a good theoretical training and meanwhile devote sufficient time to the practical work, so that he may become a proficient engineer, both in theory and in practice in the various branches of Mechanical Engineering.

II. MECHANICAL ENGINEERING

FIRST YEAR

FIRST TERM	Periods per week
Algebra (1)	2
Geometry (2)	1
Practical Physics (7)	2
Practical Physics Problems (8)	1
Mechanical Drawing (9)	3

SECOND TERM	Periods per week
Trigonometry (4)	2
Logarithms and Slide Rule (3)	1
Practical Physics (7)	2
Practical Physics Problems (8)	1
Mechanical Drawing (9)	3

SECOND YEAR

FIRST TERM	Periods per week
Advanced Mathematics (5)	2
Practical Mechanics (16)	2
Mechanism (25)	2
Advanced Mechanical Drawing (26)	3

SECOND TERM	Periods per week
Advanced Mathematics (5)	2
Practical Mechanics (16)	2
Strength of Materials I (17)	2
Advanced Mechanical Drawing (26)	3

THIRD YEAR

FIRST TERM	Periods per week
Strength of Materials II (18)	2
Hydraulics (30)	2
Thermodynamics(32)	2
Machine Drawing and Design (27)	3

SECOND TERM	Periods per week
Materials of Construction (28)	2
Hydraulic Motors (31)	2
Thermodynamics (32)	2
Machine Drawing and Design (27)	3

FOURTH YEAR (Omitted 1918-19)

FIRST TERM	Periods per week
Elements of Electricity (36)	2
Boilers and Prime Movers (33)	2
Concrete (24)	2
Power Plant Design (34)	3

SECOND TERM	Periods per week
Direct Current Machinery I (38)	2
Foundations (29)	1
Concrete (24)	2
Power Plant Design (34)	3
Mechanical Supplies and Processes (35)	1

III. ELECTRICAL ENGINEERING

Electrical Engineering has developed rapidly in recent years and students are required to have a thorough appreciation of physical theory, as well as a broad working knowledge of Mathematics. It is essential that students planning to take this course should realize the fundamental necessity of obtaining a solid grounding in these subjects.

It is not the purpose of the course to attempt the impossible aim of turning out fully trained engineers in the various branches of the science, especially as it is becoming daily more and more differentiated and specialized. The course is designed rather to lay a broad and thorough foundation for future progress along the lines of work which may particularly appeal to the individual, and give him a good working acquaintance with the essential principles which underlie each of the more specialized branches of professional activity. Parallel with the theoretical work, runs a carefully planned course of laboratory work which is intended to develop the student's powers of accurate observation, of planning work and methods for himself, with due regard to saving of time and precision of results. For more detailed matters the reader is referred to the description of the several courses and subjects of instruction.

III. ELECTRICAL ENGINERING

FIRST YEAR

FIRST TERM	Periods per week
Algebra (1)	2
Geometry (2)	1
Practical Physics (7)	2
Practical Physics Problems (8)	1
Mechanical Drawing (9)	3

SECOND TERM	Periods per week
Trigonometry (4)	2
Logarithms and Slide Rule (3)	1
Practical Physics (7)	2
Practical Physics Problems (8)	1
Mechanical Drawing (9)	3

SECOND YEAR

FIRST TERM	Periods per week
Advanced Mathematics (5)	2
Practical Mechanics (16)	2
Elements of Electricity Lectures (36)	2
Elements of Electricity Laboratory (37)	3

SECOND TERM	Periods per week
Advanced Mathematics (5)	2
Practical Mechanics (16)	2
D. C. Machinery I, Lectures (38)	2
D. C. Machinery I, Laboratory (39)	3

THIRD YEAR

FIRST TERM	Periods per week
D. C. Machinery II, Lectures (38)	2
D. C. Machinery II, Laboratory (39)	3
Hydraulics (30)	2
Thermodynamics (32)	2

SECOND TERM	Periods per week
Alt. Currents, Lectures (40)	2
Alt. Currents and Elect. Meas. Laboratory (41)	3
Hydraulic Motors (31)	2
Thermodynamics (32)	2

FOURTH YEAR (Omitted 1918-19.)

FIRST TERM	Periods per week
A. C. Machinery, Lectures (42)	2
A. C. Machinery, Laboratory (43)	3
Generation and Utization of Power (44)	2
Boilers and Prime Movers (33)	2

SECOND TERM	Periods per week
A. C. Machinery, Lectures (42)	2
A. C. Machinery, Laboratory (43)	3
Generation and Utilization of Power (44)	3
Mechanical Supplies and Processes (35)	1

IV. CHEMICAL ENGINEERING

The great industrial advance of recent years has placed the chemical industry in the front rank of progress. The most potent reason for this may be found in the replacement of the old rule of thumb methods with scientific methods.

Owing to keen competition, manufacturers have been compelled to utilize every product of their plants, and this has called for skilled chemical knowledge. The course in Chemical Engineering has, for its purpose, the training of students competent to take responsible places in the operation of industries based on chemical principles.

During their course many students are employed in chemical industries as gas manufacturing plants, chemical engineering companies, etc. They not only get an excellent training in the theory of such work at school, but also a knowledge of the commercial side of the industry as well.

The class work includes a training in Inorganic, Organic, Analytical and Theoretical Chemistry, which is accompanied by appropriate laboratory work.

IV. CHEMICAL ENGINEERING

FIRST YEAR

FIRST TERM	Periods per week
Algebra (1)	2
Elements of Physics (6)	2
Inorganic Chemistry, Lectures (45)	2
Inorganic Chemistry, Laboratory (46)	3

SECOND TERM	Periods per week
Trigonometry (4)	2
Elements of Physics (6)	2
Inorganic Chemistry, Lectures (45)	2
Inorganic Chemistry, Laboratory (46)	3

SECOND YEAR

FIRST TERM	Periods per week
Qualitative Analysis, Lectures (47)	2
Qualitative Analysis, Laboratory (48)	7

SECOND TERM	Periods per week
Qualitative Analysis, Lectures (47)	2
Qualitative Analysis, Laboratory (48)	7

THIRD YEAR

FIRST TERM	Periods per week
Volumetric Analysis, Lectures (49)	2
Volumetric Analysis, Laboratory (49)	6
German I (54)	1

SECOND TERM	Periods per week
Gravimetric Analysis, Lectures (50)	2
Gravimetric Analysis, Laboratory (50)	6
German I (54)	1

FOURTH YEAR (Omitted 1918-19)

FIRST TERM	Periods per week
Principles of Chemistry, Lectures (53)	1
Organic Chemistry, Lectures (51)	1
Organic Chemistry, Laboratory (52)	6
German II (55)	1

SECOND TERM	Periods per week
Principles of Chemistry, Lectures (53)	1
Organic Chemistry, Lectures (51)	1
Organic Chemistry, Laboratory (52)	6
German II (55)	1

V. STRUCTURAL ENGINEERING

The purpose of this course is to give the student a special training in those subjects comprised under the term "Structural Engineering." It is designed to give the student sound and thorough training in the science upon which professional practice is based.

Structural Engineering covers such a broad field that no one can become expert in its whole extent. It includes the design and construction of girders, columns, roofs, trusses, arches, bridges, buildings, walks, dams, foundations and all fixed structures and movable bridges. It includes also a knowledge of the relative merits of the design and construction of buildings, bridges and structures composed of the different materials used by the engineer, such as concrete, reinforced concrete, timber, cast iron and steel. Structural Engineering also includes cost accounting, plan reading and estimating.

The course is designed to prepare the young engineer to take up the work of assisting in the design and construction of structures; to undertake intelligently supervision of erection work in the field and general contracting.

V. STRUCTURAL ENGINEERING

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (7)	2	Practical Physics (7)	2
Practical Physics Problems (8)	1	Practical Physics Problems (8)	1
Mechanical Drawing (9)	3	Mechanical Drawing (9)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Advanced Mathematics (5)	2	Advanced Mathematcs (5)	2
Surveying (10)	2	Strength of Materials I (17)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Structural Drawing (19)	3	Structural Drawing (19)	3

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Strength of Materials II (18)	2	Materials of Construction (28)	2
Theory of Structures (20)	4	Theory of Structures (20)	4
Structural Design (21)	3	Structural Design (21)	3

FOURTH YEAR (Omitted 1918-19)

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Advanced Structures (22)	3	Advanced Structures (22)	3
Plan Reading and Estimating (23A)	1	Foundations (29)	1
Concrete (24)	2	Concrete (24)	2
Bridge Design (23)	3	Bridge Design (23)	3

SUBJECTS OF INSTRUCTION

Instruction is given by lectures and recitations, and by practical exercises in the field, the laboratories, and the drawing rooms. A great value is set upon the educational effect of these exercises, and they form the foundation of each of the courses. Text-books are used in many subjects, but not in all. In many branches the instruction given differs widely from available text-books and in most of such cases, notes on the lectures and laboratory work are furnished to the students. Besides oral examinations in connection with the ordinary exercises, written examinations are held from time to time. At the close of the year, general examinations are held.

In the following pages will be found a detailed statement of the scope of the subjects offered in the various courses. The subjects are classified, as far as possible, related studies being arranged in sequence.

The subjects are numbered, or numbered and lettered, for convenience of reference in consulting the various Course Schedules.

The requisites for preparation include not only the subjects specified by number, but also those required as a preparation for them. The reason for this is that to carry on properly the more advanced subjects, the student must have become proficient in all the elementary subjects. Some studies, specified as being required in preparation, may be taken simultaneously. The student must complete such subjects before starting on more advanced work.

By careful consideration of the Course Schedules, in connection with the following Description of Subjects, the applicant for a special course may select, for the earlier part of that course, such subjects as will enable him to pursue later those more advanced subjects which he may particularly desire.

Applications for exception from the required preparation, as stated in connection with each subject described below, will be passed on by the Faculty.

The topics, included in the list which follows, are subject to change at any time by action of the School authorities.

SYNOPSIS OF SUBJECTS

Regular Courses

1. Algebra

Preparation: Elementary Algebra

This course is taken by all regular students during the first term of the first year and consists of a general review of Algebra up to quadratic equations, and a continuation including quadratic equations, ratio and proportion, variation, and the use of formulas, with applications to problems in Physics and Engineering.

2. Geometry

Preparation: Elements of Plane Geometry

This course is taken by all regular students during the first term of the first year. It consists of a rapid review of the useful theorems, with special reference to mensuration.

3. Logarithms and Slide Rule

Preparation: 1

This course is taken by all regular Engineering students during the second term of the first year. Instruction is given in the theory of logarithms with thorough drill in their use, with applications to the solution of exponential equations, especially in formulas; the theory and use of Slide Rules, including a general discussion of precision and rules for significant figures.

4. Trigonometry

Preparation: 1, 2, 3

This course is taken by all first year students during the second term of the first year. It consists of lectures and recitations covering radians, coördinates, trigonometric ratios, formulas, law of sines, law of cosines, solution of right and oblique triangles, with applications to problems in Engineering.

5. Advanced Mathematics

Preparation: 4

This course is taken by all regular engineering students throughout the second year. Instruction is given by lectures and recitations in the following subjects: Plotting of func-

tions, interpolation, the straight line, the conic sections, curves represented by various equations of common occurrence in engineering, graphic solution of equations, determination of laws from the data of experiments, simplification of formulas; rate of change, differentiation, integration, definite integrals with applications to the determination of mean value, area, volume, centre of gravity and moment of inertia.

6. Elements of Physics

A course of experimental lectures and exercises, designed especially for students of Chemistry. The work is devoted to a study of the mechanics of solids, liquids, and gases; heat and its effects; and elementary electricity. The problems are also planned to give drill work in Mathematics in its applications to Physics and Chemistry.

7. Practical Physics

This course consists of two lectures per week throughout the first year. Instruction is given in the practical application of physical laws. Each lecture, so far as possible, is accompanied by practical tests in the lecture room on large size apparatus, built especially for this course, so that the student may actually see a demonstration of the truth of the various laws, thus enabling him to grasp readily the underlying principles. The course is devoted to a study of the mechanics of solids, liquids and gases, heat and its effects, together with lectures on light and sound. Practical problems covering each phase of the work are given throughout the year which are designed to fix in the student's mind the fundamental principles taken up in the lectures.

8. Practical Physics Problems

This course is taken by all regular students taking the course in Practical Physics (7), and is designed to give a more thorough understanding of the application of the principles discussed in the lectures to the solution of problems.

9. Mechanical Drawing

This course is of an elementary character, and is planned on the assumption that the student has had no experience in the use of drawing instruments. Instruction is given in the use of instruments, the T-square, triangles and French curves, and in the fundamental rules for making drawings. Simple geometrical constructions and the principle of orthographic projections are studied.

10. Surveying

Preparation: 4

The first term is devoted to a study of surveying instruments, the methods of making surveys, and the solution of problems in plane surveying.

In the second term, the methods used in topographic surveying, together with the problems relating thereto, are taken up in detail, as well as advanced and special problems in plane surveying. A study is also made of triangulation and barometric leveling.

Special emphasis is laid on the construction and use of the various kinds of maps and plans with which the surveyor should be familiar.

11. Topographical Drawing

Preparation: 9

This course is primarily designed to give training in the interpretation and drawing of topographical maps. It is devoted to the study of the different conventional signs employed, and each student is required to make a number of plates and to become reasonably proficient in the preparation of such maps. Particular attention is given to the study of contour maps with applications to the solution of problems.

12. Highway Engineering

Preparation: 10

The subjects considered in this course are the location, construction, and maintenance of roads, street design, and street drainage, sidewalks, pavement foundations, and the construction, cost and maintenance of the various kinds of pavements, including asphalt, brick, cobble-stone, stone-block, and wood-block, together with a discussion of the relative merits of these types of pavements.

13. Railroad Engineering

Preparation: 10

This course consists of instruction in the computation and methods of laying out simple, compound, reverse, and easement curves; frogs, switches, and turnouts; the computation of earthwork by different methods, slope stakes, borrow pits, and cross section work.

14. Railroad Engineering Drawing

Preparation: 10

From field notes, a map and profile of a preliminary survey for a railroad are plotted, the location is discussed and adjusted to the preliminary map. Other drawings involving the study of problems common to railroad practice are taken up. The course is supplemented by lectures.

15. Engineering Problems

A course dealing with various problems encountered by town and city engineers, such as the examination of water supply, quality of water, public health in its relation to water supply, methods of purification of water, water pipes, reservoirs, stand pipes, dams, and pumping machinery; sewerage systems, sizes and design of sewers, methods of construction and inspection of sewers, modern methods of purification of sewage and garbage disposal; and the making of contracts and writing of specifications for various kinds of construction work.

16. Practical Mechanics

Preparation: 4, 6, 7

A course of lectures and recitations which comprise a study of the general methods and applications of statics, including the determination of reactions, stresses in frames, of distributed forces and center of gravity, moment of inertia and radius of gyration of plane areas and solids. Kinematics and dynamics are also taken up, including the equations for uniform and varying rectilinear motion, centrifugal force, work, power and kinetic energy.

17. Strength of Materials

Preparation: 16

This course comprises a study of the strength of materials, mathematically treated. The subjects studied are: the stresses and strains in bodies subjected to tension, to compression and to shearing; common theory of beams, with thorough discussion of the distribution of stresses, shearing forces and bending moments; longitudinal shear, slopes and deflections, and the strength of shafts and springs.

18. Strength of Materials II

Preparation: 17

This is a continuation of Strength of Materials I in which a study is made of the combined stresses in beams subjected to

tension and compression, as well as bending; also of the strength of hooks and columns, the design of riveted joints, and thin, hollow cylinders. A brief consideration of strains, and the relations of the stresses on different planes in a body, and the stresses in simple frames subjected to bending forces, is taken up in the latter part of the course.

19. Structural Drawing

Preparation: 9

The course in structural drawing consists in the working out of various graphical problems of mechanics on the drawing board, drawing standard sections of structural steel shapes, structural details and the preparation of drawings, representing simple structures. The purpose of this course is to familiarize the student with detailed drawings and teach him where and how to dimension structural parts on working drawings.

20. Theory of Structures

Preparation: 17 and 18

This course consists of lectures, recitations and solution of problems. Instruction is given in the fundamental theory of structures, including the theory of beams, computation of reactions, moments, and shears for static and moving loads. The work in the class-room is supplemented by the solution of many practical problems in the drawing room.

21. Structural Design

Preparation: 19 and 20

The course in structural design consists of work in the drawing room. It is a continuation of the course in structural drawing given in the second year, and includes the execution of elementary structural design, taking up in a practical way the principles given in the course in Theory of Structures. Each student is given data for various problems, the designs for which he works out in the drawing-room, making all necessary computations and executing all drawings necessary for the preparation of a complete design of a number of engineering structures.

22. Advanced Structures

Preparation: 20

This course is a continuation of the theory of structures given in the third year, and takes up the fundamental prin-

ciples involved in the design of various engineering structures, such as buildings, bridges, retaining walls, arches and other structures, as the time permits. Instruction is given by means of lectures and recitations, and the various theoretical principles are applied in the execution of practical designs in the drawing room.

23. Bridge Design

Preparation: 21

Most of the work of this course is done in the drawing room, but instruction is given from time to time by means of lectures. The work includes the execution of complete designs for several types of structures, such as railroad bridges and building trusses, and the execution of complete working drawings.

24. Concrete

Preparation: 17 and 18

The course consists of lectures, interrogations, blackboard exercises, and practical problems for home work on plain and reinforced concrete and masonry construction. It covers the history of cement, ancient and modern, the kinds of cement and methods of manufacture, concrete constuction, mixing, proportioning, selection of materials, testing, forms and inspection; the design of reinforced concrete, beams with tension steel only, beams with tension and compression steel, stirrups, tee-beams, plain columns, hooped columns, eccentric columns, flat-slab or girderless floors, building details, plain and reinforced retaining walls, footing and foundations. Building code requirements and American Society of Civil Engineer recommendations are taken up in conjunction with the text books.

This course, while a part of the regular engineering course, is especially adapted to outside students who wish to become familiar with the principles of design and modern practice in reinforced concrete construction.

25. Mechanism

Preparation: 9 and 5

This course is devoted to a study of the principles involved in Machinery and in the mechanical transmission of power. The problem work takes up the design of pulleys, belts, gearing and gear teeth development, cams, and quick return motions used in machine tools such as shapers, slotters, and planers.

26. Advanced Mechanical Drawing

Preparation: 9

This course is a continuation of Mechanical Drawing, and includes problems on the point, line, and plane; projections of solids; single and double curved surfaces and their intersections by oblique planes; and practical applications of the principles studied.

27. Machine Drawing and Design

Preparation: 9, 26

The aim of this course is to teach the proper way of making the necessary dimensioned drawings for use in practice, good shop systems being adopted. The instruction includes the making of working detail and assembly drawings of machinery from measurements. Much time is devoted to a study of the elementary principles of design.

28. Materials of Construction

Preparation: 17 and 18

This course consists of two lectures, or recitations during the second term of the third year, in the study of methods of testing and the strength of various materials used by the engineer. A detailed study is also made of the methods of manufacturing, properties, and uses, of materials used in engineering work, such as lime, cement, concrete, brick, wood, stone, iron and steel.

29. Foundations

Preparation: 17 and 18

A course covering the method of construction and design of the various kinds of foundations used in engineering construction, together with a study of the bearing power of different kinds of soil.

30. Hydraulics

Preparation: 5

In this course both Hydrostatics and Hydrodynamics are discussed, and many practical problems are solved throughout the work. Under Hydrostatics, the pressures on submerged areas, together with their points of application, are studies; under Hydrodynamics, the flow of water through orifices, short tubes, nozzles, over weirs, and through pipes and open channels is taken up for discussion.

31. Hydraulic Motors

Preparation: 30

A series of exercises, mainly recitations devoted to a study of impulse wheels and reaction turbines, with reference to their proper construction, regulation and testing, and to the various sources of loss of energy in their operation. Practical problems relating to stream flow, storage and development of water power are considered.

32. Thermodynamics

Preparation: 5

This course is devoted to the study of the theory of perfect gases and thermodynamics. The use of steam and entropy tables and solutions of general problems in steam; also heating and ventilation.

33. Boilers and Prime Movers

Preparation: 32

This course is devoted to the study of the practical operation of boilers and boiler accessories and the principles of boiler design. The work also covers the essentials of steam engine and turbine design and strength of parts of steam engines such as piston rods, cylinders, crossheads, flywheels, etc.

34. Power Plant Design

Preparation: 33

A course of two and one quarter hours per week, partly lectures and partly drawing room work, in power plant design and layout. The course treats of the proper layout of boilers, pipes, condensers, separators, ash and coal handling machinery, and a study of the building itself, as well as engine beds, chimney design, and chimney foundations.

35. Mechanical Supplies and Processes

This course is intended to familiarize the student with the commercial names and sizes of engineering products, such as bar and plate stock, shafting, tubing, pipes, valves, bearings and hangers, belts, pulleys, etc. A discussion of such manufacturing processes as extension, broadening, press work, electric and oxy-acetylene welding, cold and hot rolling and drawing, etc., is included.

36. Elements of Electricity

Preparation: 7

A course of lectures, recitations, and problem work during the first term of the second year. The course deals with the fundamental laws and properties of electric and magnetic circuits and their application to simple types of electrical apparatus. Particular emphasis is placed on the units of resistance, current, potential, and power, and on Ohm's Law and Kirchhoff's Laws.

37. Elements of Electricity, Laboratory

Preparation: 36

This course is taken in connection with the corresponding class room course in Elementary Electricity, and the experiments performed are intended to illustrate and supplement that work.

38. Direct Current Machinery I and II

Preparation: 36, 37

A course of lectures, recitations, and problem work during the second term of the second year and the first term of the third year. The course is devoted to the study of the principles and operation of direct current machinery. The following topics are considered: direct current generators and motors, their construction, operation and application; direct current systems involving the use of generators, motors, storage batteries, etc., in combination; electric lighting and photometry.

39. Direct Current Machinery I and II, Laboratory

Preparation: 38

This course of one evening per week during the second term of the second year and the first term of the third year, is taken simultaneously with the corresponding lecture course, and the experiments are intended to supplement the class-room work of that course. The experiments cover the operation of a dynamo as a motor and generator, the photometer, etc. The characteristics of direct current generators and motors are determined experimentally; efficiency, losses, regulation and heating are carefully studied in the laboratory. Each student is required to furnish a complete report, including theory, method of procedure, results, and conclusions on each experiment performed by him.

40. Alternating Currents

Preparation: 38

A course of lectures, recitations, and problem work during the second term of the third year. The principles of electromagnetism, electrostatics, variable currents, and harmonic alternating currents, including both single and polyphase circuits, are carefully studied.

41. Alternating Currents and Electrical Measurements, Laboratory

Preparation: 40

A course of one evening per week during the second term of the third year. The course is devoted to the experimental study of alternating current circuits, power measurements in single and polyphase circuits, and selected experiments in direct and alternating current measurements.

42. Alternating Current Machinery

Preparation: 40

A course of lectures, recitations, and problem work throughout the fourth year. The course is devoted to a detailed study of the construction, theory, and application of alternating current machines, such as the transformer, alternator, synchronous motor, induction motor, rotary converter, and the various types of single phase motors.

43. Alternating Current Machinery, Laboratory

Preparation: 42

This course of one evening per week, throughout the fourth year, consists of laboratory exercises devoted to experimental study of the transformer, alternator, and other types of alternating current apparatus, supplementing the corresponding class room work of Course 42.

44. Generation, Transmission and Utilization of Electrical Power

Preparation: 42

A course of lectures, recitations, and problem work throughout the fourth year. This course is intended to cover the field of electrical engineering in a broader and more general way than do the other more technical courses previously taken. It deals with the various types of genertaing stations,

some of the features of long distance power transmission, the application of electric power to railways, some of the problems of illumination, and other subjects.

45. Inorganic Chemistry

Preparation: 6

A course of experimental lectures on the fundamental laws and principles of inorganic chemistry. The work aims to familiarize the student with the properties and preparation of the following elements and their most important compounds: —oxygen, hydrogen, the halogens, surfur, nitrogen, phosphorus, carbon, silicon, the alkali and alkaline earth groups, iron and aluminum. The course is to be taken in conjunction with 46.

46. Inorganic Chemistry, Laboratory

A laboratory course in which the student is expected to verify and illustrate the facts and principles that have been discussed in the lectures. To be taken in conjunction with 45.

47. Qualitative Analysis

Preparation: 45, 46

A practical course in qualitative analysis relating to the identification of the common metallic elements and the ordinary acids.

48. Qualitative Analysis, Laboratory

Preparation: 47

A practical course in qualitative analysis for the separation and identification of the common metallic elements and the acids. Each student is also required to make a complete and accurate analysis of various mixtures, alloys and chemicals used in manufacturing.

49. Volumetric Analysis

Preparation: 47, 48

A course on volumetric determinations, involving the use and the standardization of burettes, pipettes and measuring flasks. The work includes alkalimetry, acidemetry, indicators, oxidmetry, iodimetry, chlorimetry. The laboratory work is supplemented by lectures and conferences.

50. Gravimetric Analysis

Preparation: 47, 48

A course devoted to the principles and practice of gravimetric analysis. The laboratory work is supplemented by lectures and conferences.

51. Organic Chemistry

Preparation: 47, 48

The course is devoted to lectures and conferences on the principles of organic chemistry, as illustrated by the methane and benzene derivations.

52. Organic Chemistry, Laboratory

Preparation: 47, 48

In this course the student is required to prepare in the laboratory a number of organic compounds, selected to show the characteristic reactions, and to give training in the practical separation and purification of organic substances. After this synthetic work, the students are given a practical course in organic analysis.

53. Principles of Chemistry

Preparation: 47, 48

A course of lectures and conferences on chemical equilibrium and electro-chemical topics. The work includes lecture experiments and discussion of problems on the law of mass action, applied to the rate and equilibrium of chemical reactions, the effect of temperature and pressure, the conduction of electricity by solutions, the production of electricity by chemical change, the electromotive force of voltaic cells and single potential differences. Problems for independent solution by the student are also given.

54 and 55. German I and II

These courses of one hour per week throughout the third and fourth years respectively, are planned to give the student a knowledge of German grammar as well as a working vocabulary of scientific terms.

SPECIAL COURSES

56. Architectural Drawing I (Omitted 1918-1919)

An elementary course, including the fundamental principles underlying all kinds of mechanical and architectural drawing; geometrical problems; orthographic and isometric projections; classical mouldings; Roman alphabet, and roof problems.

In connection with this course the instructor will outline a course of reading in architectural history.

57. Architectural Drawing II (Omitted 1918-1919)

Preparation: 56

The orders of Architecture. Practical architecture and details of construction. In this course the student is taught the component parts of buildings. Typical details of construction are drawn to a large scale and in isometric projection.

58. Architectural Drawing III (Omitted 1918-1919)

Preparation: 57

This course covers the making of complete plans, elevations and working drawings of some elementary problem.

Special Students

Students desiring special work in Architectural Drawing, not outlined above, should consult with the instructor.

59 and 60. Freehand Drawing I and II (Omitted 1918-1919)

Considering the great importance of the study of freehand drawing to all who are engaged in, or anticipate being engaged in any industrial art, artistic trade or profession, we offer a very complete course in this line, and call attention to the splendid advantages provided.

The work is adapted to the requirements of each individual student, so far as is practical and consistent with a thorough training in freehand drawing. There are two classes in both freehand drawing and industrial design.

Class I. The work of this class is intended to meet the wants of those students who have no previous knowledge of freehand drawing and is recommended to all students who intend to become craftsmen, designers, architects or artists,

and also to others who may wish to take up the study as an accomplishment. The work will consist of drawing from typical models, by which students learn a sense of proportion and the principles of perspective; groups of still life for the study of composition and color; also drawing of historic ornament, and details of the human figure from the cast, by which students are taught to observe form, and the principles of light and shade.

Class II. The course of study in this class is of a more advanced nature than that of Class I, and in addition to the more complicated forms of ornament, the full-length human figure from the antique is added, also rendering in pen and ink and pencil, advanced shading in charcoal, painting groups of still life in monochrome and polychrome, in oil and water colors.

61. Industrial Design and Interior Decoration (Omitted 1918-1919)

The courses in industrial design and interior decoration are specially helpful to those students who are already engaged in or anticipate being engaged in such arts and crafts, as wood and stone carving, wrought and bent-iron work, brass and copper work, stained glass, furniture and drapery, interior decoration, book covers, wall paper, fabrics and other allied industrial arts, including lettering and commercial designing for advertising purposes. No limitation is placed upon the student who shows ability to take up the work prescribed for the class he wishes to enter, and students who so desire may spend part of their time in the freehand class and part in the industrial design and interior decoration class, without extra charge. Students in industrial design are recommended to take architecture.

62. Life Class (Omitted 1918-1919)

At the repeated request of a number of advanced students we offer this class which will give an exceptional opportunity to students who wish to pursue their studies for the purpose of acquiring a more perfect knowledge of the figure, and will be of great advantage to those who wish to become more proficient in this branch of art. At the present time the use of

the figure is introduced into nearly every form of art work, not only in a purely artistic sense, but also in many forms of commercial work, and to be able to draw the figure well is a great achievement to the artist and designer. This work will only be given when a sufficient number of students enroll for it.

Equipment

The school is now housed in the new building of the Association, and has very exceptionally equipped quarters for carrying on the work of the Engineering Courses.

MECHANICAL ENGINEERING DEPARTMENT

Our steam engineering plant is completely equipped with meters, scales, indicators, and all the necessary accessory equipment for making complete boiler tests, and determining the efficiencies of the various appliances used in generating power, heat, and light for our new building. This places at the disposal of our classes a perfectly equipped, up-to-date, engineering department, and gives them the means of carrying on boiler tests, determining the efficiencies of various fuels and oils, taking indicator diagrams, determining the efficiency of modern reciprocating engines and turbines when direct connected to generators, as well as renders them familiar with all the various auxiliary appliances of such a plant, as condensers, pumps, air compressors, etc. The students also have the use of the equipment of our Automobile School, thus giving opportunity to study the most advanced ideas in gasoline engine practice.

In addition to the foregoing, a small but completely equipped shop for the construction and repair of apparatus and for the use of students in connection with their thesis work has been installed. This shop is equipped with a metal and woodworking lathe, grinder, and all the necessary wood and metal-working tools. There is also a very complete set of cabinet-worker's tools for use in woodworking.

CIVIL ENGINEERING DEPARTMENT

Field Instruments

For work in the field the Department possesses various surveying instruments, representing the principal makes and types of instruments in general use. The equipment includes transits, levels, compasses, a complete plane table outfit, Locke hand level, flag poles, leveling rods, stadia rod, engineers' and surveyors' chains, steel and cloth tapes and other accessories. For higher surveying, an aneroid barometer is used for barometric leveling, and the transits are equipped with neutral glasses and reflectors for astronomical observations, as well as a sextant, reading to ten seconds, and equipped with neutral glasses and telescopes. A new Plane Table Outfit and a Berger 18-inch Wye Level, as well as several smaller instruments, were added to the equipment.

The scope of the equipment and the field work itself are designed to train the student's judgment as to the relative merits of the various types of field instruments.

Design and Drafting Rooms

The School possesses large, light, and well-equipped drawing rooms for the carrying on of the designing and drafting, which form so important a part of civil engineering work. These rooms are supplied with lockers containing the drawing supplies, and files containing blue prints and photographs of structures that represent the best practice. Many of the prints and photographs are of structures erected in and about Boston.

ELECTRICAL ENGINEERING DEPARTMENT

The Electrical Measurements Laboratory is well equipped with apparatus for teaching the principles of measurements, and the equipment is being steadily increased and developed for the performance of a wider range of work. The special pieces of apparatus are as follows: A modified form of Conductivity Bridge, a Laboratory Wheatstone Bridge, a Leeds and Northrup Potentiometer with volt box, standard cells and low resistance standards, and a chemical balance. A 600 am-

pere-hour storage battery has been added to the equipment for current tests, while for voltage work there is a high-voltage direct-current generator, having separate field excitation and speed control, for wide range of voltage adjustment.

Among the instruments used for alternating current testing are the following: Three General Electric wattmeters, constructed for Y connection; a General Electric polyphase indicating wattmeter, with double current and potential ranges; a General Electric indicating wattmeter, with double current and potential ranges, constructed for the measurement of transformer core loss, three Thomson high-torque induction watt-hour meters, with special gear trains for short-time readings; a General Electric and a Westinghouse, switchboard type, integrating watt-hour meter, and a Thomson rotating standard test meter. There is also a large number of indicating ammeters and voltmeters, and auxiliary testing apparatus, such as synchronism and frequency indicators.

For direct current testing there is a considerable number of Weston and General Electric ammeters and voltmeters of suitable ranges, and two Thomson integrating watt-hour meters.

For direct current testing there is a considerable number of Weston and General Electric ammeters and voltmeters of suitable ranges, and two Thomson integrating watt-hour meters.

There is also an increasing assortment of testing devices, such as speed counters, tachometers, brakes, loading resistances, and numerous minor pieces of apparatus needed in the practical operation and testing of electrical machinery.

Among the machines of this department are a pair of specially made matched machines, constructed to operate as single, two, or three phase generators, or motors, as well as synchronous converters, or double current generators. On the direct-current side, these machines will operate as shunt, series, or compound generators, either two or three wire, or as shunt, series, or compound motors. There are also a 15 H. P. Westinghouse compound motor, a 3 K. W. compound generator, two one-half H. P. series motors, a one-half H. P. shunt motor, and a 1 K. W. series generator, a 5 H. P. General Elec-

tric interpole motor, a 5 H. P. General Electric series motor, a 4 H. P. shunt motor, two 3 H. P. shunt motors, and a 2 H. P. shunt motor.

There is also a 7½ kv-a. special General Electric alternator driven by a 10 H. P. General Electric interpole motor, and a 5 kv-a. Holtzer Cabot alternator driven by a 10 H. P. Fort Wayne shunt motor. This latter machine has two special rotors, permitting its use as a squirrel-cage or phase-wound, induction motor. In addition, there is a 5 K. W. Holtzer-Cabot three-phase synchronous convertor, a 5 H. P. General Electric induction motor, which can be operated two or three phase, a 45 kv-a. single phase alternator, giving practically a pure sine wave, and three General Electric transformers, each of 3 kv-a. capacity. During the past year there has been added three special 1 K. W. single-phase transformers, each of 3 kv-a. capacity.

There is also available for advanced instruction, in co-operation with the Mechanical Engineering Department, the four three-wire generators in the main generating plant. Two of these generators are driven by Ridgeway reciprocating engines and two by Westinghouse-Parson turbines.

DEPARTMENT OF PHYSICS

There is a large laboratory devoted entirely to Physics, together with a lecture room.

The Physics Department has been very completely equipped with all necessary apparatus for the experimental work that is required of the students, as well as that required for lecture demonstration. Among other things have been added verniers, levels, spherometers, calorimeters, thermometers, pyrometers, a spectroscope, a microscope, a spectrometer, balances, standard gram weight, lecture table galvanometer, optical disk with all accessories, lenses, photometer, a full set of Weather Bureau apparatus, including a barograph, thermograph, hygrometer, barometer, maximum and minimum thermometers, etc. These, in addition to the equipment already owned, give a wide range to the experimental work that can be done.

DEPARTMENT OF CHEMISTRY

This Department is completely equipped in all respects for carrying on all lines of Chemical work, from that of a high school to that of most advanced college grade. The three laboratories, with accommodations for over one hundred and fifty students, are very exceptionally furnished with all the necessary appliances for chemical work. Some of these are: hoods, drying closets, still, steam and hot water baths, electrolytic circuits, vacuum and pressure apparatus, balances, combustion furnaces, complete sets of apparatus for the sampling and analysis of flue gases and fuels. There are also testing machines for oils, viscosimeters, and different sorts of flash point apparatus. A chemical museum is connected with this Department where are kept specimens for purposes of illustration.

LIBRARIES

There is in connection with the School, a professional library containing books pertaining to both the school work of the students and to their practical work. In addition to this there are also current periodicals on engineering and scientific subjects for their exclusive use. All members of the School are entitled to take books from the Boston Public Library, and this offers a very unusual opportunity to our non-resident students.

DEPARTMENT OF PHYSICAL TRAINING

Our new gymnasium with all the latest modern equipment gives ample accommodation for all students.

There is a running track on the grounds adjoining, together with tennis and hand ball courts; also a large natatorium where swimminig is taught by competent instructors.

In connection with this Department there are also six excellent bowling alleys, which may be used by the students upon the payment of a nominal fee.

For all further information, write

THE EVENING SCHOOL OF ENGINEERING,

316 Huntington Ave., Boston, Mass.

Courses of Study

Schedule of Engineering Subjects

(Arranged alphabetically by subjects)

Subject Number	*Subject*	*Evenings*	*Time*
5	Advanced Mathematics	Mon. and Thurs.	8.30—9.15
26	Advanced Mechanical Drawing	Wed. (or Fri.)	7.00—9.15
22	Advanced Structures	Mon.	7.00—7.45
		Thurs.	7.00—8.30
1	Algebra	Mon. and Thurs.	7.00—7.45
40	Alternating Currents, Lectures	Mon. and Thurs.	7.45—9.15
41	Alternating Currents and Electrical Measurements, Laboratory	Wed.	7.00—9.15
42	Alternating Current Machinery, Lectures	Mon. and Thurs.	8.30—9.15
43	Alternating Current Machinery, Laboratory	Fri.	7.00—9.15
33	Boilers and Prime Movers	Mon. and Thurs.	7.45—8.30
23	Bridge Design	Tues.	7.00—9.15
24	Concrete	Mon. and Thurs.	8.30—9.15
38	Direct Current Machinery, Lectures I	Mon. and Thurs.	7.00—7.45
38	Direct Current Machinery, Lectures II	Mon. and Thurs.	8.30—9.15
39	Direct Current Machinery, Laboratory I	Wed.	7.00—9.15
39	Direct Current Machinery, Laboratory II	Wed.	7.00—9.15
36	Elements of Electricity, Lectures	Mon. and Thurs.	7.00—7.45
37	Elements of Electricity, Laboratory	Wed.	7.00—9.15
6	Elements of Physics	Mon. and Thurs.	8.30—9.15
15	Engineering Problems	Thurs.	7.00—9.15
29	Foundations	Mon.	7.45—8.30
44	Generation, Transmission and Utilization of Electricity	Mon. and Thurs.	7.00—7.45
2	Geometry	Mon.	7.45—8.30
54	German I	Wed.	8.30—9.15
55	German II	Wed.	8.30—9.15
50	Gravimetric Analysis	Mon., Tues. and Wed.	7.00—9.15
12	Highway Engineering	Tues.	8.30—9.15
30	Hydraulics	Mon. and Thurs.	7.00—7.45
31	Hydraulic Motors	Mon. and Thurs.	7.00—7.45
45	Inorganic Chemistry, Lectures	Mon. and Thurs.	7.45—8.30
46	Inorganic Chemistry, Laboratory	Wed.	7.00—9.15
3	Logarithms and Slide Rule	Mon.	7.45—8.30
27	Machine Drawing and Design	Wed. (or Fri.)	7.00—9.15

Subject Number	Subject	Evenings	Time
28	Materials of Construction	Mon. and Thurs.	8.30—9.15
9	Mechanical Drawing	Wed.	7.00—9.15
35	Mechanical Supplies and Processes	Thurs.	7.45—8.30
25	Mechanism	Mon. and Thurs.	7.00—7.45
51	Organic Chemistry, Lectures	Wed.	7.45—8.30
52	Organic Chemistry, Laboratory	Mon. and Tues.	7.00—9.15
34	Power Plant Design	Wed.	7.00—9.15
16	Practical Mechanics	Mon. and Thurs.	7.45—8.30
7	Practical Physics	Mon. and Thurs.	8.30—9.15
8	Practical Physics Problems	Thurs.	7.45—8.30
53	Principles of Chemistry	Wed.	7.00—7.45
47	Qualitative Analysis, Lectures	Mon. and Thurs.	7.00—7.45
48	Qualitative Analysis, Laboratory	Mon. and Thurs.	7.45—9.15
		Tues.	7.00—9.15
13	Railroad Engineering	Mon. and Thurs.	8.30—9.15
14	Railroad Engineering Drawing	Wed.	7.00—9.15
17	Strength of Materials I	Mon. and Thurs.	7.00—7.45
18	Strength of Materials II	Mon. and Thurs.	8.30—9.15
21	Structural Design	Tues.	7.00—9.15
19	Structural Drawing	Tues.	7.00—9.15
10	Surveying	Mon. and Thurs.	7.00—8.30
20	Theory of Structures	Mon. and Thurs.	7.00—8.30
32	Thermodynamics	Mon. and Thurs.	7.45—8.30
11	Topographical Drawing	Tues.	7.00—8.30
4	Trigonometry	Mon. and Thurs.	7.00—7.45
49	Volumetric Analysis	Mon., Tues. and Wed.	7.00—9.15

Special Courses

56	Architectural Drawing I	Mon. and Fri.	7.30—9.30
57	Architectural Drawing II	Mon. and Fri.	7.30—9.30
58	Architectural Drawing III	Mon. and Fri.	7.30—9.30
59	Freehand Drawing I	Tues. and Thurs.	7.30—9.30
60	Freehand Drawing II	Tues. and Thurs.	7.30—9.30
61	Industrial Design	Tues. and Thurs.	7.30—9.30
62	Life Class	Tues. and Thurs.	7.30—9.30

RATES OF TUITION

Regular Four Year Courses

The tuition for the first year of all regular four year courses is thirty-five (35) dollars, payable as follows:

$15.00 upon entering
$10.00 November 15
$10.00 January 15

The tuition for all years but the first, of the regular courses shall be fifty (50) dollars, payable as follows:

$20.00 upon entering
$15.00 November 15
$15.00 January 15

Beginning in September, 1919, all full Courses, now costing fifty dollars, will be advanced to fifty-five dollars for the year's tuition, this increased rate will not apply to students enrolled previous to September, 1917. The foregoing rates include membership in the Association.

Individual Engineering Subjects

(Arranged alphabetically by subjects)

	Course	*Tuition*
5	Advanced Mathematics	15.00
26	Advanced Mechanical Drawing	20.00
22	Advanced Structures	20.00
1	Algebra	10.00
40	Alternating Currents, Lectures	10.00
41	Alternating Currents, and Electrical Measurements, Laboratory	10.00
42	Alternating Current Machinery, Lectures	15.00
43	Alternating Current Machinery, Laboratory	20.00
33	Boilers and Prime Movers	15.00
23	Bridge Design	20.00
24	Concrete	20.00
38	Direct Current Machinery I and II, Lectures	20.00
39	Direct Current Machinery I and II, Laboratory	20.00
36	Elements of Electricity, Lectures	10.00
37	Elements of Electricity, Laboratory	10.00
6	Elements of Physics	15.00
15	Engineering Problems	20.00
29	Foundations	8.00
44	Generation, Transmission and Utilization of Electricity	20.00
2	Geometry	8.00
54	German I	8.00
55	German II	8.00
50*	Gravimetric Analysis	30.00
12	Highway Engineering	10.00
30	Hydraulics	10.00
31	Hydraulic Motors	10.00

	Course	Tuition
45*	Inorganic Chemistry, Lectures	13.00
46*	Inorganic Chemistry, Laboratory	13.00
3	Logarithms and Slide Rule	8.00
27	Machine Drawing and Design	15.00
28	Materials of Construction	10.00
9	Mechanical Drawing	12.00
35	Mechanical Supplies and Processes	8.00
25	Mechanism	10.00
51*	Organic Chemistry, Lectures	10.00
52*	Organic Chemistry, Laboratory	50.00
34	Power Plant Design	20.00
16	Practical Mechanics	15.00
7	Practical Physics	15.00
8	Practical Physics Problems	8.00
53*	Principles of Chemistry	10.00
47*	Qualitative Analysis, Lectures	15.00
48*	Qualitative Analysis, Laboratory	40.00
13	Railroad Engineering	15.00
14	Railroad Engineering Drawing	20.00
17	Strength of Materials I	10.00
18	Strength of Materials II	10.00
21	Structural Design	20.00
19	Structural Drawing	20.00
10	Surveying	25.00
20	Theory of Structures	25.00
32	Thermodynamics	15.00
11	Topographical Drawing	10.00
4	Trigonometry	10.00
49*	Volumetric Analysis	30.00

* Owing to the increased price of all materials used in the chemical laboratories, due to war conditions, a laboratory fee of four dollars per year will be charged to each student taking courses in the chemical laboratories. In addition, a laboratory deposit of four dollars will be required. This deposit is returnable upon payment of all breakage and other charges.

Special Courses

56	Architectural Drawing I	10.00
57	Architectural Drawing II	10.00
58	Architectural Drawing III	10.00
59	Freehand Drawing I	10.00
60	Freehand Drawing II	10.00
61	Industrial Design	10.00
62	Life Class	10.00

Special Note.—The above rates are in addition to membership ($2). In case more than one subject is taken, a discount of $3 for each additional subject will be made.

NORTHEASTERN COLLEGE

SCHOOL OF LAW

Evening Sessions

Established in 1898; incorporated in 1904. Provides a four years' course in preparation for the Bar, and grants the Degree of Bachelor of Laws.

SCHOOL OF COMMERCE AND FINANCE

Evening Sessions

Established in 1907; incorporated in 1911. Offers the following three and four-year courses leading to the degree of B. C. S. (Bachelor of Commercial Science): Business Administration and Professional Accountancy. Anyone passing the examination for advanced standing is enabled to complete any one of the four regular courses and secure the degree in three years. Special courses in addition to regular courses.

CO-OPERATIVE SCHOOL OF ENGINEERING

Day Sessions

Four-year courses in Civil, Mechanical, Electrical, Chemical and Industrial Engineering, in co-operation with engineering firms. Students earn while learning. Open to High School graduates.

EVENING SCHOOL OF ENGINEERING

Evening Sessions

A school offering four-year courses in Civil, Mechanical, Electrical, Chemical and Structural Engineering.

SCHOOL OF LIBERAL ARTS

Evening Sessions

Courses of college grade in English, Ancient and Modern Languages, Mathematics, Science, History, Education and Journalism have been offered. Professors and instructors of New England colleges have been engaged. These courses are open to graduates of high schools and to others who can meet the entrance requirements.

For further information concerning any of the above schools or departments, address

NORTHEASTERN COLLEGE

316 Huntington Avenue, Boston, Massachusetts

THE EVENING SCHOOL OF ENGINEERING

FOUNDED FOR THE INSTRUCTION OF MEN IN THE THEORY AND PRACTICE OF ENGINEERING

NORTHEASTERN COLLEGE

JUNE 1919

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1919-1920

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Northeastern College

CATALOG OF THE

Evening School of Engineering

1919—1920

316 HUNTINGTON AVENUE
BOSTON, MASSACHUSETTS

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GENERAL INFORMATION

Many men in various lines of industry feel the need of special instruction in Engineering, either to advance in their normal occupation, or to enable them to change their positions and get into work of an Engineering nature.

To such men the Evening School of Engineering offers a wide variety of regular Engineering Courses, and in addition, special instruction for those who desire it, in Architecture, Drawing, Design, Radio Telegraphy and Concrete. The Engineering Courses require attendance three evenings a week, during a period of three years. While only the fundamental subjects are taken up, the courses compare very favorably with similar courses offered by the good technical schools.

Three-year Engineering Courses

Regular three-year courses, leading to a diploma, are offered in the following branches of Engineering:

I Civil Engineering
II Mechanical Engineering
III Electrical Engineering
IV Chemical Engineering
V Structural Engineering

Special Courses

Special courses in Architecture and Radio Telegraphy are offered by the School, and will be found described in detail in the latter part of this catalog.

Requirements for Admission

The work carried on in the Engineering Courses assumes that the entering student has had previous training in Elementary Algebra to quadratics, Plane Geometry, and has a good ground-work in English. An entering student should have completed at least the equivalent of from one to two years' work in a good high school. Those who have completed a full high-school course should be well fitted to carry on the courses and derive the maximum benefit from the work.

The men who finished grammar school, but who have not had the requisite previous training in Mathematics and Eng-

lish, can attend the Evening Courses of the Northeastern Preparatory School, and should be able to get the necessary preparation for entrance to the Engineering School in from one to two years.

There are no entrance examinations for entering students, but each applicant for admission is required to have an interview with the Dean or the Director.

The qualifications of each applicant will be ascertained and he will be advised as to just what work he is qualified to undertake.

Should a student prove to be unable to carry on his studies successfully, he may be required to discontinue any subject in which he is deficient, and complete such preparatory work as is deemed necessary, before being re-admitted to the subject in question.

Tuition Fees

For each of the regular three-year Engineering Courses the tuition fees are as follows:

The first year tuition in any full Course is fifty (50) dollars.

This amount, which includes membership in the Association, is payable as follows:

$20.00 upon entering the School
$15.00 November 15
$15.00 January 15

The tuition fee for all years, except the first, is sixty dollars, which includes membership in the Association. This amount is payable as follows:

$30.00 upon entering the School
$15.00 November 15
$15.00 January 15

The tuition fee for special courses will be found on page 36.

Refunds

Refunds will be granted in accordance with the regular rules of the College. In computing refunds, students shall be charged at the rate of three dollars per week for each week of school attendance, and in addition to this, shall be charged an extra five dollars, over and above this weekly rate. The date

of withdrawal of any student shall be the day on which the School receives formal notice of his intentions to leave.

Laboratory Fees

All students taking courses in the Chemical Laboratories are charged a laboratory fee of five dollars. This fee is payable in advance, does not cover breakage or destruction of apparatus, and will not be refunded.

An additional laboratory deposit of five dollars must be made before a desk will be assigned to a student. At the close of the school year the cost of equipment broken by the student or not returnable will be deducted from this amount and the balance refunded. Students failing to check up their desks upon leaving school will be charged one dollar extra.

Transfers

No student is permitted to transfer from one course to another without consulting the Dean or Director beforehand and receiving a transfer order, which must be presented at the School office for the proper transfer card.

Reports of Standing

An informal report of the students' standing is issued at the end of the first term, and a formal report, covering the year's work, is issued at the close of each year.

Positions Held by Graduates

The graduates of the School are in constant demand, and it may be said that those who complete one of the courses successfully can be sure of desirable employment in his chosen line.

Naturally the School does not guarantee to place its graduates in positions. This is not necessary since our graduates have no difficulty in finding places for themselves.

Special Students

A special student may take any subject, upon the approval of the Dean or Director, provided he has had the necessary preliminary training.

Scholarships

As an aid to worthy men who desire an education and are unable to pay the tuition fees, a limited number of scholarships has been provided, which will be granted by the Board of Governors, to whom application should be made. Students who can afford to pay are requested not to apply for this privilege.

Diplomas

Upon the satisfactory completion of any of the regular courses, the student is entitled to receive a diploma.

COURSES OF STUDY

GENERAL STATEMENT

The schedules of the various courses are given on the following pages. The first-year work of all courses is practically the same, with a few exceptions, which are made because of the need of the student for elementary training in his professional subjects.

The school year comprises twenty-eight weeks of class work, and one week of examinations. The twenty-eight weeks are divided into two terms of fourteen weeks each. The subjects in the Course Outlines on the following pages have been arranged by terms. Opposite these subjects will be found the number of periods of forty-five minutes each of class work, recitation, laboratory or the drawing room. The number in parenthesis, following the subject, is the number by which that subject is identified in the descriptive matter under "Subjects of Instruction."

When a student elects a course, he is required to complete all subjects in that course in order to receive a diploma. No subject is to be dropped, or omitted, without the consent of the Dean or Director.

I. CIVIL ENGINEERING

The purpose of this course is to give the student an education in those subjects which form the basis of all branches of technical education, and a special training in those subjects comprised under the term "Civil Engineering." It is designed to give the student sound training, both theoretical and practical, in the sciences upon which professional practice is based.

Civil Engineering covers such a broad field that no one can become expert in its whole extent. It includes Topographical Engineering, Municipal Engineering and Railroad Engineering. It covers land surveying the construction of sewers, waterworks, roads and streets. All these branches of Engineering rest, however, upon a relatively compact body of principles, and in these principles the students are trained by practice in the class room, drawing room and the field.

The course is designed to prepare the young engineer to take up the work of assisting in the location and construction of steam and electric railways, sewerage and water supply systems, etc.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (6)	2
Surveying (11)	4	Surveying (11)	4
Topographical Drawing (12)	2	Topographical Drawing (12)	2
Highway Engineering (13)	1	Highway Engineering (13)	1

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Hydraulics (27)	2	Strength of Materials I (17)	2
Railroad Engineering (14)	2	Railroad Engineering (14)	2
Railroad Engineering Drawing (15)	3	Railroad Engineering Drawing (15)	3

II. MECHANICAL ENGINEERING

This course is designed to give a foundation in those fundamental subjects which form the bases for all professional engineering practice, and especially to equip the young engineer with a knowledge of the various phases of Mechanical Engineering. The course embraces instruction by text-book, lecture and drawing room.

The course affords training in the methods, and gives practice in the process of Construction, which develops in the student the capacity for thinking along mechanical lines, thus enabling him to base all his work upon fundamental principles already learned, rather than upon empirical rules. It is the endeavor to give the student a good theoretical training and meanwhile devote sufficient time to the practical work, so that he may become a proficient engineer, both in theory and in practice in the various branches of Mechanical Engineering.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (6)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Materials of Construction (25)	2	Strength of Materials I (17)	2
Mechanical Engineering Drawing (22)	3	Machine Drawing (23)	3

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Strength of Materials II (18)	2	Foundations (26)	2
Hydraulics (27)	2	Hydraulic Motors (28)	2
Thermodynamics (29)	2	Thermodynamics (29)	2
Machine Design (24)	3	Machine Design (24)	3

III. ELECTRICAL ENGINEERING

Electrical Engineering has developed rapidly in recent years and students are required to have a thorough appreciation of physical theory, as well as a broad working knowledge of Mathematics. It is essential that students planning to take this course should realize the fundamental necessity of obtaining a solid grounding in these subjects.

It is not the purpose of the course to attempt the impossible aim of turning out fully trained engineers in the various branches of the science, especially as it is becoming daily more and more differentiated and specialized. The course is designed rather to lay a broad and thorough foundation for future progress along the lines of work which may particularly appeal to the individual, and give him a good working acquaintance with the essential principles which underlie each of the more specialized branches of professional activity. Parallel with the theoretical work, runs a carefully planned course of laboratory work which is intended to develop the student's powers of planning work for himself.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (16)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Direct Currents, Lectures (30)	2	Direct Currents, Lectures (30)	2
Direct Currents, Laboratory (31)	3	Direct Currents, Laboratory (31)	3

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Alternating Currents, Lectures (32)	2	Alt. Currents, Lectures (32)	2
Alternating Currents, Laboratory (33)	3	Alt. Currents, Laboratory (33)	3
Hydraulics (27)	2	Hydraulic Motors (28)	2
Thermodynamics (29)	2	Thermodynamics (29)	2

IV. CHEMICAL ENGINEERING

The great industrial advance of recent years has placed the chemical industry in the front rank of progress. The most potent reason for this may be found in the replacement of the old rule-of-thumb methods with scientific methods.

Owing to keen competition, manufacturers have been compelled to utilize every product of their plants, and this has called for skilled chemical knowledge. The course in Chemical Engineering has for its purpose the training of students competent to take responsible places in the operation of industries based on chemical principles.

During their course many students are employed in chemical industries as gas manufacturing plants, chemical engineering companies, etc. They not only get an excellent training in the theory of such work at school, but also a knowledge of the commercial side of the industry as well.

The class work includes a training in Inorganic, Organic, Analytical and Theoretical Chemistry, which is accompanied by appropriate laboratory work.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Chemical Physics (7)	2	Chemical Physics (7)	2
Inorganic Chemistry, Lectures (34)	2	Inorganic Chemistry, Lectures (34)	2
Inorganic Chemistry, Laboratory (35)	3	Inorganic Chemistry, Laboratory (35)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Chemistry, Lectures (36)	2	Analytical Chemistry, Lectures (36)	2
Analytical Chemistry, Laboratory (37)	7	Analytical Chemistry, Laboratory (37)	7

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Organic Chemistry, Lectures (38)	2	Organic Chemistry, Lectures (38)	2
Organic Chemistry, Laboratory (39)	6	Organic Chemistry, Laboratory (39)	6

V. STRUCTURAL ENGINEERING

The purpose of this course is to give the student a special training in those subjects comprised under the term "Structural Engineering." It is designed to give the student sound and thorough training in the science upon which professional practice is based.

Structural Engineering covers such a broad field that no one can become expert in its whole extent. It includes the design and construction of girders, columns, roofs, trusses, arches, bridges, buildings, walks, dams, foundations and all fixed structures and movable bridges. It includes also a knowledge of the relative merits of the design and construction of buildings, bridges and structures composed of the different materials used by the engineer, such as concrete, reinforced concrete, timber, cast iron and steel. Structural Engineering also includes cost accounting, plan reading and estimating.

The course is designed to prepare the young engineer to take up the work of assisting in the design and construction of structures; to undertake intelligently supervision of erection work in the field and general contracting.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (6)	2
Materials of Construction (25)	2	Strength of Materials I (17)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Structural Drawing (19)	3	Structural Drawing (19)	3

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Strength of Materials II (18)	2	Foundations (26)	2
Theory of Structures (20)	4	Theory of Structures (20)	4
Structural Design (21)	3	Structural Design (21)	3

SUBJECTS OF INSTRUCTION

Instruction is given by lectures and recitations, and by practical exercises in the field, the laboratories and the drawing rooms. A great value is set upon the educational effect of these exercises, and they form the foundation of each of the courses. Text-books are used in many subjects, but not in all. In many branches the instruction given differs widely from available text-books and in most of such cases, notes on the lectures and laboratory work are furnished to the students. Besides oral examinations in connection with the ordinary exercises, written examinations are held from time to time. At the close of the year, general examinations are held.

In the following pages will be found a detailed statement of the scope of the subjects offered in the various courses. The subjects are classified, as far as possible, related studies being arranged in sequence.

The subjects are numbered, or numbered and lettered, for convenience of reference in consulting the various Course Schedules.

The requisites for preparation include not only the subjects specified by number, but also those required as a preparation for them. The reason for this is that to carry on properly the more advanced subjects, the student must have become proficient in all the elementary subjects. Some studies, specified as being required in preparation, may be taken simultaneously. The student must complete such subjects before starting on more advanced work.

By careful consideration of the Course Schedules, in connection with the following Description of Subjects, the applicant for a special course may select, for the earlier part of that course, such subjects as will enable him to pursue later those more advanced subjects which he may particularly desire.

The topics, included in the list which follows, are subject to change at any time by action of the School authorities.

SYNOPSIS OF SUBJECTS

Regular Courses

1. Algebra

Preparation: Elementary Algebra

This course is taken by all regular students during the first term of the first year and consists of a general review of Algebra up to quadratic equations, and a continuation including quadratic equations, ratio and proportion, variation and the use of formulas, with applications to problems in Physics and Engineering.

2. Geometry

Preparation: Elements of Plane Geometry

This course is taken by all regular students during the first term of the first year. It consists of a rapid review of the useful theorems, with special reference to mensuration.

3. Logarithms and Slide Rule

Preparation: 1

In this course instruction is given in the theory of logarithms with thorough drill in their use, with applications to the solution of exponential equations, especially in formulas; the theory and use of Slide Rules, including a general discussion of precision and rules for significant figures.

4. Trigonometry

Preparation: 1, 2, 3

This course consists of lectures and recitations covering radians, coördinates, trigonometric ratios, formulas, law of sines, law of cosines, solution of right and oblique triangles, with applications to problems in Engineering.

5. Analytical Geometry

Preparation: 4

In this course instruction is given by lectures and recitations in the following subjects: Plotting of functions, interpolation, the straight line, the conic sections, curves represented by various equations of common occurrence in engineering, graphic solution of equations, determination of laws from the data of experiments, simplification of formulas.

6. Calculus

Preparation: 4 and 5

This course is taken by all regular engineering students during the second term of the second year. Instruction is given by lectures and recitations in the following subjects: rate of change, differentiation, integration, definite integrals, with applications to the determination of mean value, area, volume, center of gravity and moment of inertia.

7. Chemical Physics

A course of experimental lectures and exercises, designed especially for students of Chemistry. The work is devoted to a study of the mechanics of solids, liquids and gases; heat and its effects; and elementary electricity. The problems are also planned to give drill work in Mathematics in its applications to Physics and Chemistry.

8. Practical Physics

Preparation: 1, 2

This course consists of two lectures per week throughout the first year. Instruction is given in the practical application of physical laws. Each lecture, so far as possible, is accompanied by practical tests in the lecture room on large-size apparatus, built especially for this course, so that the student may actually see a demonstration of the truth of the various laws, thus enabling him to grasp readily the underlying principles. The course is devoted to a study of the mechanics of solids, liquids and gases, heat and its effects, together with lectures on light and sound. Practical problems covering each phase of the work are given throughout the year, which are designed to fix in the student's mind the fundamental principles taken up in the lectures.

9. Practical Physics Problems

Preparation: 8

This course is taken by all regular students taking the course in Practical Physics (8), and is designed to give a more thorough understanding of the application of the principles discussed in the lectures to the solution of problems.

10. Mechanical Drawing

This course is of an elementary character, and is planned on the assumption that the student has had no experience in the use of drawing instruments. Instruction is given in the use of instruments, the T-square, triangles and French curves, and in the fundamental rules for making drawings. Simple geometrical constructions and the principle of orthographic projections are studied.

11. Surveying

Preparation: 4

The first term is devoted to a study of surveying instruments, the methods of making surveys, and the solution of problems in plane surveying.

In the second term, the methods used in topographic surveying, together with the problems relating thereto, are taken up in detail, as well as advanced and special problems in plane surveying. A study is also made of triangulation and barometric leveling.

Special emphasis is laid on the construction and use of the various kinds of maps and plans with which the surveyor should be familiar.

12. Topographical Drawing

Preparation: 10

This course is primarily designed to give training in the interpretation and drawing of topographical maps. It is devoted to the study of the different conventional signs employed, and each student is required to make a number of plates and to become reasonably proficient in the preparation of such maps. Particular attention is given to the study of contour maps with applications to the solution of problems.

13. Highway Engineering

Preparation: 11

The subjects considered in this course are the location, construction and maintenance of roads, street design and street drainage, sidewalks, pavement foundations and the construction, cost and maintenance of the various kinds of pavements, including asphalt, brick, cobble-stone, stone-block and wood-block, together with a discussion of the relative merits of these types of pavements.

14. Railroad Engineering

Preparation: 11

This course consists of instruction in the computation and methods of laying out simple, compound, reverse and easement curves; frogs, switches and turnouts; the computation of earthwork by different methods, slope stakes, borrow pits and cross-section work.

15. Railroad Engineering Drawing

Preparation: 10, 14

From field notes, a map and profile of a preliminary survey for a railroad are plotted, the location is discussed and adjusted to the preliminary map. Other drawings involving the study of problems common to railroad practice are taken up. The course is supplemented by lectures.

16. Practical Mechanics

Preparation: 4, 7, 8

A course of lectures and recitations which comprise a study of the general methods and applications of statics, including the determination of reactions, stresses in frames, of distributed forces and center of gravity, moment of inertia and radius of gyration of plane areas and solids. Kinematics and dynamics are also taken up, including the equations for uniform and varying rectilinear motion, centrifugal force, work, power and kinetic energy.

17. Strength of Materials I

Preparation: 16

This course comprises a study of the strength of materials, mathematically treated. The subjects studied are: the stresses and strains in bodies subjected to tension, to compression and to shearing; common theory of beams, with thorough discussion of the distribution of stresses, shearing forces and bending moments; longitudinal shear, slopes and deflections, and the strength of shafts and springs.

18. Strength of Materials II

Preparation: 17

This is a continuation of Strength of Materials I in which a study is made of the combined stresses in beams subjected to

tension and compression, as well as bending; also of the strength of hooks and columns, the design of riveted joints, and thin, hollow cylinders. A brief consideration of strains, and the relations of the stresses on different planes in a body, and the stresses in simple frames subjected to bending forces, is taken up in the latter part of the course.

19. Structural Drawing

Preparation: 10, 16

The course in structural drawing consists in the working out of various graphical problems of mechanics on the drawing board, drawing standard sections of structural steel shapes, structural details and the preparation of drawings, representing simple structures. The purpose of this course is to familiarize the student with detailed drawings and teach him where and how to dimension structural parts on working drawings.

20. Theory of Structures

Preparation: 18

This course consists of lectures, recitations and solution of problems. Instruction is given in the fundamental theory of structures, including the theory of beams, computation of reactions, moments, and shears for static and moving loads. The work in the classroom is supplemented by the solution of many practical problems in the drawing room.

21. Structural Design

Preparation: 19 and 20

The course in structural design consists of work in the drawing room. It is a continuation of the course in structural drawing given in the second year, and includes the execution of elementary structural design, taking up in a practical way the principles given in the course in Theory of Structures. Each student is given data for various problems, the designs for which he works out in the drawing room, making all necessary computations and executing all drawings necessary for the preparation of a complete design of a number of engineering structures.

22. Mechanical Engineering Drawing

Preparation: 10

This course is a continuation of Mechanical Drawing, and includes problems on the point, line and plane; projections

of solids; single and double curved surfaces and their intersections by oblique planes; and practical applications of the principles studied.

The principles of Mechanism are also studied. The problem work takes up the design of pulleys, belts, gearing and gear teeth development, cams and quick return motions used in machine tools such as shapers, slotters and planers.

23. Machine Drawing

Preparation: 10, 22

The aim of this course is to teach the proper way of making the necessary dimensioned drawings for use in practice, good shop systems being adopted. The instruction includes the making of working detail and assembly drawings of machinery from measurements.

24. Machine Design

Preparation: 18, 23

This course aims to give the student practice in the application of theoretical principles previously studied and at the same time acquaint him with the many practical details which must be considered in design work. The problems taken up in the early part of the course are of a static nature, while the later problems involve dynamical stresses. The problems of the course vary from year to year, but the following are typical of the designs taken up: arbor press, hydraulic flanging clamp, crane, air compressor, punch and shear, stone-crusher, etc.

In each design the constructive details are carefully considered, with special attention to methods of manufacture, provision for wear, lubrication, etc. The work is based on rational rather than empirical methods, the student being required to make all calculations for determining the sizes of the various parts and all necessary working drawings.

25. Materials of Construction

Preparation: 8 and 16

This course consists of two lectures, or recitations during the first term of the second year, in the study of methods of testing and the strength of various materials used by the engineer. A detailed study is also made of the methods of

manufacturing, properties and uses, of materials used in engineering work, such as lime, cement, concrete, brick, wood, stone, iron and steel.

26. Foundations

Preparation: 17 and 18

A course covering the method of construction and design of the various kinds of foundations used in engineering construction, together with a study of the bearing power of different kinds of soil.

27. Hydraulics

Preparation: 5

In this course both Hydrostatics and Hydrodynamics are discussed, and many practical problems are solved throughout the work. Under Hydrostatics, the pressures on submerged areas, together with their points of application, are studied; under Hydrodynamics, the flow of water through orifices, short tubes, nozzles, over weirs, and through pipes and open channels is taken up for discussion.

28. Hydraulic Motors

Preparation: 27

A series of exercises, mainly recitations devoted to a study of impulse wheels and reaction turbines, with reference to their proper construction, regulation and testing, and to the various sources of loss of energy in their operation. Practical problems relating to stream flow, storage and development of water power are considered.

29. Thermodynamics

Preparation: 5

This course is devoted to the study of the theory of perfect gases, thermodynamics and power plants. The use of steam and entropy tables and solutions of general problems in steam. Problems in heating and ventilation and lay-out of power plants are also studied.

30. Direct Currents, Lectures

Preparation: 8

A course of lectures, recitations and problem work during the second year, dealing with the fundamental laws and

properties of electric and magnetic circuits. The course is devoted to the study of the principles of direct-current machinery.

31. Direct Currents, Laboratory

Preparation: 30

This course of one evening per week is taken in connection with the corresponding classroom course in Direct Currents, and the experiments performed are intended to illustrate and supplement that work. Each student is required to furnish a complete report, including theory, method of procedure, results and conclusions on each experiment performed by him.

32. Alternating Currents, Lectures

Preparation: 30

A course of lectures, recitations and problem work during the third year, dealing with the principles of electromagnetism, electrostatics, variable currents and harmonic currents including both single-phase and polyphase circuits. A detailed study is made of the construction, theory and application of alternating-current machines.

33. Alternating Currents, Laboratory

Preparation: 31 and 32

This course of one evening per week is taken in connection with the corresponding classroom work in alternating currents, and the experiments performed are intended to illustrate and supplement that work. Each student is required to furnish a complete report, including theory, method of procedure, results and conclusions on each experiment performed by him.

34. Inorganic Chemistry

Preparation: 7

A course of experimental lectures on the fundamental laws and principles of inorganic chemistry. The work aims to familiarize the student with the properties and preparation of the following elements and their most important compounds: —oxygen, hydrogen, the halogens, sulfur, nitrogen, phosphorus, carbon, silicon, the alkali and alkaline earth groups, iron and aluminum. The course is to be taken in conjunction with 35.

35. Inorganic Chemistry, Laboratory

Preparation: 34

A laboratory course in which the student is expected to verify and illustrate the facts and principles that have been discussed in the lectures. To be taken in conjunction with 34.

36. Analytical Chemistry, Lectures

Preparation: 34

A practical course in qualitative and quantitative analysis consisting of lectures relating to the separation and indentification of the common metallic elements and the ordinary acids. The latter part of the year will be devoted to lectures and conferences on the fundamental principles of volumetric and gravimetric analysis.

37. Analytical Chemistry, Laboratory

Preparation: 36

This course in the laboratory is devoted to the separation and indentification of common elements and acids in the laboratory. Each student is required to make a complete analysis of various mixtures, alloys and chemicals used in manufacturing. A study is also made of volumetric determinations involving the use and the standardization of burettes, pipettes and measuring flasks. The work includes alkalimetry acidimetry, indicators, oxidimetry, iodimetry, chlorimetry.

38. Organic Chemistry

Preparation: 36, 37

The course is devoted to lectures and conferences on the principles of organic chemistry, as illustrated by the methane and benzene derivations.

39. Organic Chemistry, Laboratory

Preparation: 38

In this course the student is required to prepare in the laboratory a number of organic compounds, selected to show the characteristic reactions, and to give training in the practical separation and purification of organic substances. After this synthetic work, the students are given a practical course in organic analysis.

Special Courses

40. Architectural Drawing I

An elementary course, including the fundamental principles underlying all kinds of mechanical and architectural drawing; geometrical problems; orthographic and isometric projections; classical moldings; Roman alphabet and roof problems.

In connection with this course the instructor will outline a course of reading in architectural history.

41. Architectural Drawing II

Preparation: 40

The orders of Architecture. Practical architecture and details of construction. In this course the student is taught the component parts of buildings. Typical details of construction are drawn to a large scale and in isometric projection.

42. Architectural Drawing III

Preparation: 41

This course covers the making of complete plans, elevations and working drawings of some elementary problem.

Special Students

Students desiring special work in Architectural Drawing not outlined above, should consult with the instructor.

43. Radio Communication

This is a lecture course with demonstrations, given three periods per week for fourteen weeks (the course being repeated during the second term of the School), covering the elementary theory of electricity, motors and generators as used in radio working, ether waves, oscillating circuits, transmitting and receiving apparatus, arrangement of circuits, etc., as applied to both telegraphic and telephonic communication.

44. Radio Code and Practice, Elementary

This course is given three evenings per week for fourteen weeks and is repeated during the second term. It is intended for men who have little or no acquaintance with the code, and

aims to bring such men up to a receiving speed of at least fifteen words per minute. A knowledge of the various message forms and regulations is also taught, together with the working of the simple sending and receiving sets.

45. Radio Code and Practice, Advanced

This course is also given three evenings per week for fourteen weeks and is repeated during the second term. It is open only to men who can already receive at the rate of twelve words per minute and is intended to carry them up to a receiving speed of at least twenty-two words per minute. It aims to teach all that is necessary to make them accomplished, skilled operators.

Men taking the elementary course during the first half year and entering this course in the second half should by the end of the year be capable of excellent work.

In these two courses in Radio Code and Practice which are under the supervision of Mr. R. G. Porter, who was on the teaching staff of the U. S. Naval Radio School at Cambridge until its termination, use will be made of the methods of instruction developed by the officers of that school assisted by the Department of Psychology of Harvard University and which have proved exceedingly efficient. A chart of normal progress is mapped out, and each man's progress in receiving is plotted from week to week, so that each man knows whether he is gaining as he should or not, and it can be determined very quickly whether or no he can develop into a speedy operator.

46. Radio Laboratory

This course will be given in connection with the regular courses in electrical laboratory work, and will consist of experiments on motor and generator action, motor control and maintainance storage batteries, etc., covering those special matters which are essential and applicable to the intelligent care and operation of the electrical machines used in transmitting sets.

EQUIPMENT

The School is now housed in the new building of the Association, and has very exceptionally equipped quarters for carrying on the work of the Engineering Courses.

MECHANICAL ENGINEERING DEPARTMENT

Our steam engineering plant is completely equipped with meters, scales, indicators and all the necessary accessory equipment for making complete boiler tests, and determining the efficiencies of the various appliances used in generating power, heat and light for our new building. This places at the disposal of our classes a perfectly equipped, up-to-date engineering department, and gives them the means of carrying on boiler tests, determining the efficiencies of various fuels and oils, taking indicator diagrams, determining the efficiency of modern reciprocating engines and turbines when direct connected to generators, as well as renders them familiar with all the various auxiliary appliances of such a plant, as condensers, pumps, air compressors, etc. The students also have the use of the equipment of our Automobile School, thus having opportunity to study the most advanced ideas in gasoline engine practice.

CIVIL ENGINEERING DEPARTMENT

Field Instruments

For work in the field the Civil Engineering Department possesses various surveying instruments, representing the principal makes and types of instruments in general use. The equipment includes transits, levels, compasses, plane table outfits, Locke hand levels, flag poles, leveling rods, stadia rods, engineers' and surveyors' chains, steel and cloth tapes and other accessories. For higher surveying there is an aneroid barometer for barometric leveling, and a sextant reading to ten seconds for hydrographic surveying. The transits are equipped with neutral glasses and reflectors for astronomical observations.

There have recently been added to the equipment a Keuffel & Esser 6¾″ transit, a Buff & Buff 4¾″ Mountain transit, a

Keuffel & Esser 18″ Wye level, two surveyors' compasses and a Gurley Electric Current meter for hydraulic measurements, as well as all the miscellaneous apparatus necessary to equip the extra parties that the new instruments would accommodate.

The extent of the equipment and scope of the field work itself are designed to train the student's judgment as to the relative merits of the various types of field instruments.

Design and Drafting Rooms

The School possesses large, light and well-equipped drawing rooms for the carrying on of the designing and drafting, which form so important a part of civil engineering work. These rooms are supplied with lockers containing the drawing supplies, and files containing blue prints and photographs of structures that represent the best practice. Many of the prints and photographs are of structures erected in and about Boston.

ELECTRICAL ENGINEERING DEPARTMENT

Electrical Measurements Laboratory

This is equipped with apparatus fundamentally planned for teaching the principles of measurement, rather than for the precise determination of quantitative results. Nevertheless it is necessary for the proper performance of work in the other laboratory courses that a certain amount of careful quantitative work should be done, and the equipment is being steadily increased and developed with both ends held in view.

Apparatus is available for instruction in the following: Resistance by Ohm's law, substitution and direct reflection, voltmeter methods for high resistance, insulation resistance, specific resistance, slide wire bridge, Wheatstone bridge, current by electrolysis, electrostatic capacity, inductance, Poggendorf's method of E M F comparison, etc., under the first head, and for work under the second head there is considerable apparatus, among which may be mentioned a conductivity bridge, a Laboratory standard Wheatstone bridge, a Kelvin low-resistance bridge, a Leeds Northrup potentiometer with two standard Weston cells, volt box and steady source of high voltage for voltmeter calibration, numerous standard

shunts and a 600 ampere hour storage battery for ammeter calibration, a commutator and leads for use with the Cary-Foster method and a chemical balance.

The Instrument Room is supplied with four General Electric 300-150-15 DC voltmeters, and four double-range Weston's, four single-range ammeters, six millivoltmeters with twelve interchangeable shunts of various ranges up to 100 amperes, all of high grade, together with numerous similar instruments of cheaper quality for lower-class work. For alternating current testing there are:

Three General Electric type P-3 single-phase wattmeters with double voltage and current ranges arranged for Y connection; two polyphase wattmeters of similar type and ranges, one of similar type specially constructed for measurement of core loss, three integrating wattmeters and one rotating standard.

Three 300-volt, three 150-volt and three 50-volt voltmeters.

Three 40-ampere, three 25-ampere, three 15-ampere, three 10-ampere, three 5-ampere and three 1-ampere ammeters, these all being in groups of three for polyphase work; and a laboratory standard AC voltmeter with extension coils.

There is also a considerable amount of auxiliary apparatus such as frequency indicators, synchroscopes and power factor meters.

Electrical Engineering Laboratory

This is equipped with numerous machines of different types, the size and voltage ratings being selected to reduce as much as possible the risk from large voltage and power apparatus, while at the same time availing the student of apparatus of commercial sizes such that the various quantities it is desired to measure will be of reasonable dimensions.

Small machines are used mostly for this reason, and also because the students in their engineering practice come in contact with the large sized and varied machinery of modern power houses and electrical plants continually.

Among the machines of this department are a pair of specially made matched machines, constructed to operate as single, two or three phase generators or motors, as well as synchronous converters, or double-current generators. On the direct-current side, these machines will operate as shunt, series or compound generators, either two or three wire, or

as shunt, series or compound motors. There is a 15 H.P. Westinghouse compound motor, a 3 K.W. compound generator, a 1 K.W. series generator, a 5 H.P. General Electric interpole motor, a 5 H.P. General Electric series motor, a 4 H.P. shunt motor, two 3 H.P. shunt motors, and a 2 H.P. shunt motor; also a 7½ kv-a. special General Electric alternator driven by a 10 H.P. General Electric interpole motor, and a 5 kv-a. Holtzer-Cabot alternator driven by a 10 H.P. Fort Wayne shunt motor. This last machine has two special rotors, permitting its use as a squirrel-cage or phase-wound, induction motor. In addition, there is a 5 K.W. Holtzer-Cabot three-phase synchronous converter, a 5 H.P. General Electric induction motor, which can be operated two or three phase, a 15 kv-a. three-phase alternator, giving practically a pure sine wave, and three General Electric transformers, each of 3 kv-a. capacity. During the past year there have been added three special 1 K.W. single-phase transformers, with leads arranged to give various types of transformer primary and secondary connections, also a set of reactances for making up three-phase inductive loads with extremely low power factor, and a similar set of condensers.

There is also available for advanced instruction, in co-operation with the Mechanical Engineering Department, the four three-wire generators in the main generating plant. Three of these generators are driven by Ridgeway reciprocating engines and one by a Westinghouse-Parson turbine.

Physics Laboratories

The Physics Department has been very completely equipped with all necessary apparatus for the experimental work that is required of the students, as well as that required for lecture demonstration. There is a large laboratory, together with a lecture room devoted entirely to Physics. Among other things have been added verniers, levels, spherometers, calorimeters, thermometers, pyrometers, a spectroscope, a microscope, a spectrometer, balances, standard gram weight, lecture table galvanometer, optical disk with all accessories, lenses, photometer, a full set of Weather Bureau apparatus, including a barograph, thermograph, hygrometer, barometer, maximum and minimum thermometers, etc. These, in addition to the equipment already owned, give a wide range to the experimental work that can be done.

Chemical Laboratories

The School has three laboratories completely equipped in all respects for carrying on all lines of chemical work, from that of a high school to that of most advanced college grade. They have accommodations for over one hundred and fifty students, and are suitably furnished with all the necessary appliances for chemical work. Some of these are: hoods, drying closets, a still, steam and hot-water baths, elecetrolytic circuits, vacuum and pressure apparatus, balances, combustion furnaces, and complete sets of apparatus for the sampling and analysis of flue gases and fuels. There are also testing machines for oils, viscosimeters, and different sorts of flash point apparatus. A chemical museum is connected with this department, where are kept specimens for purposes of illustration.

Libraries

The School shares the privileges of the steadily growing Y.M.C.A. Libraries in the Main Building. It also supports a professional library distributed among the various departments. In addition to this, it subscribes to current periodicals on engineering and scientific subjects for the exclusive use of students. All members of the School are entitled to take books from the Boston Public Library, and this offers a very unusual opportunity to our non-resident students.

Department of Physical Training

Our new gymnasium with all the latest modern equipment gives ample accommodation for all students. There is a running track on the grounds adjoining, together with tennis and hand-ball courts; also a large natatorium where swimming is taught by competent instructors. In connection with this department there are also six excellent bowling alleys, which may be used by the students upon the payment of a nominal fee.

COURSES OF STUDY

Schedule of Engineering Subjects

(Arranged alphabetically by subjects)

Subject Number	*Subject*	*Evenings*	*Time*
1	Algebra	Mon. and Thurs.	7.00–7.45
32	Alternating Currents, Lectures	Mon. and Thurs.	8.30–9.15
33	Alternating Currents, Laboratory	Fri.	7.00–9.15
36	Analytical Chemistry, Lectures	Mon. and Thurs.	7.00–7.45
37	Analytical Chemistry, Laboratory	Mon. and Thurs.	7.45–9.15
		Tues.	7.00–9.15
5	Analytical Geometry	Mon. and Thurs.	8.30–9.15
6	Calculus	Mon. and Thurs.	8.30–9.15
7	Chemical Physics	Mon. and Thurs.	8.30–9.15
30	Direct Currents, Lectures	Mon. and Thurs.	7.00–7.45
31	Direct Currents, Laboratory	Fri.	7.00–9.15
26	Foundations	Mon.	8.30–9.15
2	Geometry	Mon.	7.45–8.30
13	Highway Engineering	Tues.	8.30–9.15
27	Hydraulics	Mon. and Thurs.	7.00–7.45
28	Hydraulic Motors	Mon. and Thurs.	7.00–7.45
34	Inorganic Chemistry, Lectures	Mon. and Thurs.	7.45–8.30
35	Inorganic Chemistry, Laboratory	Wed.	7.00–9.15
3	Logarithms and Slide Rule	Mon.	7.45–8.30
23	Machine Drawing	Fri.	7.00–9.15
24	Machine Design	Fri.	7.00–9.15
25	Materials of Construction	Mon. and Thurs.	7.00–7.45
10	Mechanical Drawing	Wed.	7.00–9.15
22	Mechanical Engineering Drawing	Fri.	7.00–9.15
38	Organic Chemistry, Lectures	Wed.	7.45–8.30
39	Organic Chemistry, Laboratory	Mon. and Tues.	7.00–9.15
16	Practical Mechanics	Mon. and Thurs.	7.45–8.30
8	Practical Physics	Mon. and Thurs.	8.30–9.15
9	Practical Physics Problems	Thurs.	7.45–8.30
14	Railroad Engineering	Mon. and Thurs.	8.30–9.15
15	Railroad Engineering Drawing	Wed.	7.00–9.15
17	Strength of Materials I	Mon. and Thurs.	7.00–7.45
18	Strength of Materials II	Mon. and Thurs.	8.30–9.15
21	Structural Design	Tues.	7.00–9.15
19	Structural Drawing	Tues.	7.00–9.15
11	Surveying	Mon. and Thurs.	7.00–8.30
20	Theory of Structures	Mon. and Thurs.	7.00–8.30
29	Thermodynamics	Mon. and Thurs.	7.45–8.30
12	Topographical Drawing	Tues.	7.00–8.30
4	Trigonometry	Mon. and Thurs.	7.00–7.45

Special Courses

Subject Number	*Subject*	*Evenings*	*Time*
40	Architectural Drawing I	Mon. and Fri.	7.30–9.30
41	Architectural Drawing II	Mon. and Fri.	7.30–9.30
42	Architectural Drawing III	Mon. and Fri.	7.30–9.30
43	Radio Communication	Mon., Thurs. and Fri.	7.45–8.30
44	Radio Code and Practice (Elementary)	Mon., Thurs. and Fri.	7.00–7.45 and 8.30–9.15
45	Radio Code and Practice (Advanced)	Mon., Thurs. and Fri.	7.00–7.45 and 8.30–9.15
46	Radio Laboratory	By assignment	

	Course	*Tuition*
21	Structural Design	$30.00
19	Structural Drawing	30.00
11	Surveying	40.00
20	Theory of Structures	40.00
29	Thermodynamics	20.00
12	Topographical Drawing	20.00
4	Trigonometry	10.00

*A laboratory fee of five dollars per year will be charged to each student taking courses in the chemical laboratories. In addition, a laboratory deposit of five dollars will be required. This deposit is returnable upon payment of all breakage and other charges.

Special Courses

40	Architectural Drawing I	$20.00
41	Architectural Drawing II	20.00
42	Architectural Drawing III	20.00
43	Radio Communication	15.00
44	Radio Code and Practice (Elementary)	20.00
45	Radio Code and Practice (Advanced)	20.00
46	Radio Laboratory	20.00

Special Note.—The above rates are in addition to membership ($2). In case more than one subject is taken, a discount of $3 for each additional subject will be made.

NORTHEASTERN COLLEGE

SCHOOL OF LAW

Evening Sessions

Established in 1898; incorporated in 1904. Provides a four-years' course in preparation for the Bar, and grants the Degree of Bachelor of Laws.

SCHOOL OF COMMERCE AND FINANCE

Evening Sessions

Established in 1907; incorporated in 1911. Offers the following three- and four-year courses leading to the degree of B.C.S. (Bachelor of Commercial Science): Business Administration and Professional Accountancy. Any one passing the examination for advanced standing is enabled to complete any one of the four regular courses and secure the degree in three years. Special courses in addition to regular courses.

CO-OPERATIVE SCHOOL OF ENGINEERING

Day Sessions

Four-year courses in Civil, Mechanical, Electrical and Chemical Engineering, in coöperation with engineering firms. Students earn while learning. Open to high school graduates.

EVENING SCHOOL OF ENGINEERING

Evening Sessions

A school offering three-year courses in Civil, Mechanical, Electrical, Chemical and Structural Engineering.

SCHOOL OF LIBERAL ARTS

Evening Sessions

Courses of college grade in English, Ancient and Modern Languages, Mathematics, Science, History, Education and Journalism have been offered. Professors and instructors of New England colleges have been engaged. These courses are open to graduates of high schools and to others who can meet the entrance requirements.

For further information concerning any of the above schools or departments, address

NORTHEASTERN COLLEGE

316 Huntington Avenue, Boston, Massachusetts

THE EVENING
SCHOOL OF
ENGINEERING

FOUNDED FOR THE INSTRUCTION
OF MEN IN THE THEORY AND
PRACTICE OF ENGINEERING

Northeastern College

January 1920

CATALOG

of the

Evening School of Engineering

1920-1921

PUBLISHED BY THE
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THE ASSOCIATION BUILDING
HOME OF NORTHEASTERN COLLEGE

Northeastern College

CATALOG

of the

Evening School of Engineering

1920-1921

316 Huntington Avenue
BOSTON, MASSACHUSETTS

CALENDAR 1920-21

September 13-18
Registration

September 20
Opening of First Term

October 12
Columbus Day (School exercises omitted)

November 25
Thanksgiving Day (School exercises omitted)

December 23
End of First Term

December 24-31 inclusive
Christmas Recess

January 3
Opening of Second Term

February 22
Washington's Birthday (School exercises omitted)

April 8
End of Second Term

April 9
Close of School

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GENERAL INFORMATION

Many men in various lines of industry feel the need of special instruction in Engineering, either to advance in their normal occupation, or to enable them to change their positions and get into work of an Engineering nature.

To such men the Evening School of Engineering offers a wide variety of regular Engineering Courses, and in addition, special instruction for those who desire it, in Architecture, Drawing, Design, Radio Telegraphy and Concrete Construction. The Engineering Courses require attendance three evenings a week, during a period of three years. While only the fundamental subjects are taken up, the courses compare very favorably with similar courses offered by the good technical schools.

Three-year Engineering Courses

Regular three-year courses, leading to a diploma, are offered in the following branches of Engineering:

I Civil Engineering
II Mechanical Engineering
III Electrical Engineering
IV Chemical Engineering
V Structural Engineering

Special Courses

Special courses in Architecture, Concrete Construction and Radio Telegraphy are offered by the School, and will be found described in detail in the latter part of this catalog.

Requirements for Admission

The work carried on in the Engineering Courses assumes that the entering student has had previous training in Elementary Algebra to quadratics, Plane Geometry, and has a good ground-work in English. An entering student should have completed at least the equivalent of from one or two years' work in a good high school. Those who have completed a full high-school course should be well fitted to carry on the courses and derive the maximum benefit from the work.

The men who finished grammar school, but who had not

had the requisite previous training in Mathematics and English, can attend the Evening Courses of the Northeastern Preparatory School, and should be able to get the necessary preparation for entrance to the Engineering School in from one to two years.

There are no entrance examinations for entering students, but each applicant for admission is required to have an interview with the Dean.

The qualifications of each applicant will be ascertained and he will be advised as to just what work he is qualified to undertake.

Should a student prove to be unable to carry on his studies successfully, he may be required to discontinue any subject in which he is deficient, and complete such preparatory work as is deemed necessary, before being re-admitted to the subject in question.

Tuition Fees

For each year of the regular three-year Engineering Courses the tuition fee is sixty dollars. The tuition fee includes membership in the Association. This amount is payable as follows:

$30.00 upon entering the School
$15.00 November 15
$15.00 January 15

The tuition fee for special courses will be found on page 38.

Refunds

Refunds will be granted in accordance with the regular rules of the College. In computing refunds, students shall be charged at the rate of three dollars per week for each week of school attendance, and in addition to this, shall be charged an extra six dollars, over and above this weekly rate. The date of withdrawal of any student shall be taken as the day on which the School receives formal notice of his intentions to leave.

Laboratory Fees

All students taking courses in the Chemical Laboratories

are charged a laboratory fee of five dollars. This fee is payable in advance and does not cover breakage or destruction of apparatus. It is non-returnable.

An additional laboratory deposit of five dollars must be made before a desk will be assigned to a student. At the close of the school year the cost of equipment, broken by the student or, not returnable will be deducted from this amount and the balance refunded. Students failing to check up their desks upon leaving school will be charged one dollar extra.

Transfers

No student is permitted to transfer from one course to another without consulting the Dean beforehand and receiving a transfer order, which must be presented at the School office for the proper transfer card.

Reports of Standing

An informal report of the students' standing is issued at the end of the first term, and a formal report, covering the year's work, is issued at the close of each year.

Positions Held by Graduates

The graduates of the School are in constant demand, and it may be said that those who complete one of the courses successfully can be sure of desirable employment in his chosen line.

Naturally the School does not guarantee to place its graduates in positions. This is not necessary since our graduates have no difficulty in finding places for themselves.

Special Students

A special student may take any subject, upon the approval of the Dean, provided he has had the necessary preliminary training.

Scholarships

As an aid to worthy men who desire an education and are unable to pay the tuition fees, a limited number of scholarships

has been provided, which will be granted by the Board of Governors, to whom application should be made in writing. Students who can afford to pay are requested not to apply for this privilege.

Diplomas

Upon the satisfactory completion of any of the regular courses, the student is entitled to receive a diploma.

COURSES OF STUDY

GENERAL STATEMENT

The schedules of the various courses are given on the following pages. The first-year work of all courses is practically the same, with a few exceptions, which are made because of the need of the student for elementary training in his professional subjects.

The school year comprises twenty-eight weeks of class work and examinations. The twenty-eight weeks are divided into two terms of fourteen weeks each. The subjects in the Course Outlines on the following pages have been arranged by terms. Opposite these subjects will be found the number of periods of forty-five minutes each of class, recitation, laboratory or the drawing room work. The number in parenthesis, following the subject, is the number by which that subject is identified in the description matter under "Subjects of Instruction."

When a student elects a course, he is required to complete all subjects in that course in order to receive a diploma. No subject is to be dropped, or omitted, without the consent of the Dean.

I. CIVIL ENGINEERING

The purpose of this course is to give the student an education in those subjects which form the basis of all branches of technical education, and a special training in those subjects comprised under the term "Civil Engineering." It is designed to give the student sound training, both theoretical and practical, in the sciences upon which professional practice is based.

Civil Engineering covers such a broad field that no one can become expert in its whole extent. It includes Topographical Engineering, Municipal Engineering and Railroad Engineering. It covers land surveying, the construction of sewers, waterworks, roads and streets. All these branches of Engineering rest, however, upon a relatively compact body of principles, and in these principles the students are trained by practice in the class room, drawing room and the field.

The course is designed to prepare the young engineer to take up the work of assisting in the location and construction of steam and electric railways, sewerage and water supply systems, etc.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (6)	2
Surveying (11)	4	Surveying (11)	4
Topographical Drawing (12)	2	Topographical Drawing (12)	2
Highway Engineering (13)	1	Highway Engineering (13)	1

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Hydraulics (27)	2	Strength of Materials I (17)	2
Railroad Engineering (14)	2	Railroad Engineering (14)	2
Railroad Engineering Drawing (15)	3	Railroad Engineering Drawing (15)	3

II. MECHANICAL ENGINEERING

This course is designed to give a foundation in those fundamental subjects which form the bases for all professional engineering practice, and especially to equip the young engineer with a knowledge of the various phases of Mechanical Engineering. The course embraces instruction by text-book, lecture, and drawing room.

The course affords training in the methods, and gives practice in the process of Construction, which develops in the student the capacity for thinking along mechanical lines, thus enabling him to base all his work upon fundamental principles already learned, rather than upon empirical rules. It is the endeavor to give the student a good theoretical training and meanwhile devote sufficient time to the practical work, so that he may become a proficient engineer, both in theory and in practice in the various branches of Mechanical Engineering.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (6)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Materials of Construction (25)	2	Strength of Materials I (17)	2
Mechanical Engineering Drawing (22)	3	Machine Drawing (23)	3

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Strength of Materials II (18)	2	Foundations (26)	2
Hydraulics (27)	2	Hydraulic Motors (28)	2
Thermodynamics (29)	2	Thermodynamics (29)	2
Machine Design (24)	3	Machine Design (24)	3

III. ELECTRICAL ENGINEERING

Electrical Engineering has developed rapidly in recent years and students are required to have a thorough appreciation of physical theory, as well as a broad working knowledge of Mathematics. It is essential that students planning to take this course should realize the fundamental necessity of obtaining a solid grounding in these subjects.

It is not the purpose of the course to attempt the impossible aim of turning out fully trained engineers in the various branches of the science, especially as it is becoming daily more and more differentiated and specialized. The course is designed rather to lay a broad and thorough foundation for future progress along the lines of work which may particularly appeal to the individual, and give him a good working acquaintance with the essential principles which underlie each of the more specialized branches of professional activity. Parallel with the theoretical work, runs a carefully planned course of laboratory work which is intended to develop the student's powers of planning work for himself.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (16)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Direct Currents, Lectures (30)	2	Direct Currents, Lectures (30)	2
Direct Currents, Laboratory (31)	3	Direct Currents, Laboratory (31)	3

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Alternating Currents, Laboratory (33)	3	Alt. Currents, Lectures (32)	2
Alternating Currents, Lectures (32)	2	Alt. Currents, Laboratory (33)	3
Hydraulics (27)	2	Hydraulic Motors (28)	2
Thermodynamics (29)	2	Thermodynamics (29)	2

IV. CHEMICAL ENGINEERING

The great industrial advance of recent years has placed the chemical industry in the front rank of progress. The most potent reason for this may be found in the replacement of the old rule-of-thumb methods with scientific methods.

Owing to keen competition, manufacturers have been compelled to utilize every product of their plants, and this has called for skilled chemical knowledge. The course in Chemical Engineering has for its purpose the training of students competent to take responsible places in the operation of industries based on chemical principles.

During their course many students are employed in chemical industries as gas manufacturing plants, chemical engineering companies, etc. They not only get an excellent training in the theory of such work at school, but also a knowledge of the commercial side of the industry as well.

The class work includes a training in Inorganic, Analytical, and Organic Chemistry, which is accompanied by appropriate laboratory work.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Chemical Physics (7)	2	Chemical Physics (7)	2
Inorganic Chemistry, Lectures (34)	2	Inorganic Chemistry, Lectures (34)	2
Inorganic Chemistry, Laboratory (35)	3	Inorganic Chemistry, Laboratory (35)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Chemistry, Lectures (36)	2	Analytical Chemistry, Lectures (36)	2
Analytical Chemistry, Laboratory (37)	7	Analytical Chemistry, Laboratory (37)	7

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Organic Chemistry, Lectures (38)	2	Organic Chemistry, Lectures (38)	2
Organic Chemistry, Laboratory (39)	6	Organic Chemistry, Laboratory (39)	6

V. STRUCTURAL ENGINEERING

The purpose of this course is to give the student a special training in those subjects comprised under the term "Structural Engineering." It is designed to give the student sound and thorough training in the science upon which professional practice is based.

Structural Engineering covers such a broad field that no one can become expert in its whole extent. It includes the design and construction of girders, columns, roofs, trusses, arches, bridges, buildings, walks, dams, foundations and all fixed structures and movable bridges. It includes also a knowledge of the relative merits of the design and construction of buildings, bridges and structures composed of different materials used by the engineer, such as concrete, reinforced concrete, timber, cast iron and steel.

The course is designed to prepare the young engineer to take up the work of assisting in the design and construction of structures; to undertake intelligently supervision of erection work in the field and general contracting.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (6)	2
Materials of Construction (25)	2	Strength of Materials 1 (17)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Structural Drawing (19)	3	Structural Drawing (19)	3

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Strength of Materials II (18)	2	Foundations (26)	2
Theory of Structures (20)	4	Theory of Structures (20)	4
Structural Design (21)	3	Structural Design (21)	3

SUBJECTS OF INSTRUCTION

Instruction is given by lectures and recitations, and by practical exercises in the field, the laboratories and the drawing rooms. A great value is set upon the educational effect of these exercises, and they form the foundation of each of the courses. Text-books are used in many subjects, but not in all. In many branches the instruction given differs widely from available text-books and in most of such cases, notes on the lectures and laboratory work are furnished to the students. Besides oral examinations in connection with the ordinary exercises, written examinations are held from time to time.

In the following pages will be found a detailed statement of the scope of the subjects offered in the various courses. The subjects are classified, as far as possible, related studies being arranged in sequence.

The subjects are numbered, or numbered and lettered, for convenience of reference in consulting the various Course Schedules.

The requisites for preparation include not only the subjects specified by number, but also those required as a preparation for them. The reason for this is that to carry on properly the more advanced subjects, the student must have become proficient in all the elementary subjects. Some studies, specified as being required in preparation, may be taken simultaneously. The student must complete such subjects before starting on more advanced work.

By careful consideration of the Course Schedules, in connection with the following Description of Subjects, the applicant for a special course may select, for the earlier part of that course, such subjects as will enable him to pursue later those more advanced subjects which he may particularly desire.

The topics, included in the list which follows, are subject to change at any time by action of the School authorities.

SYNOPSIS OF SUBJECTS

Regular Courses

1. Algebra

Preparation: Elementary Algebra

This course is taken by all regular students during the first term of the first year and consists of a general review of Algebra up to quadratic equations, and a continuation including quadratic equations, ratio and proportion, variation and the use of formulas, with applications to problems in Physics and Engineering.

2. Geometry

Preparation: Elements of Plane Geometry

This course is taken by all regular students during the first term of the first year. It consists of a rapid review of the useful theorems, with special reference to mensuration.

3. Logarithms and Slide Rule

Preparation: 1

In this course instruction is given in the theory of logarithms with thorough drill in their use, with applications to the solution of exponential equations, especially in formulas; the theory and use of Slide Rules, including a general discussion of precision and rules for significant figures.

4. Trigonometry

Preparation: 1, 2, 3

This course consists of lectures and recitations covering radians, coördinates, trigonometric ratios, formulas, law of sines, law of cosines, solution of right and oblique triangles, with applications to problems in Engineering.

5. Analytical Geometry

Preparation: 4

In this course instruction is given by lectures and recitations in the following subjects: Plotting of functions, interpolation, the straight line, the conic sections, curves represented by various equations of common occurrence in engineering, graphic solution of equations, determination of laws from the data of experiments, simplification of formulas.

6. Calculus

Preparation: 4 and 5

This course is taken by all regular engineering students during the second term of the second year. Instruction is given by lectures and recitations in the following subjects: rate of change, differentiation, integration, definite integrals, with application to the determination of mean value, area, volume, center of gravity and moment of inertia.

7. Chemical Physics

A course of experimental lectures and exercises, designed especially for students of Chemistry. The work is devoted to a study of the mechanics of solids, liquids and gases; heat and its effects; and elementary electricity. The problems are also planned to give drill work in Mathematics in its applications to Physics and Chemistry.

8. Practical Physics

Preparation: 1, 2

This course consists of two lectures per week throughout the first year. Instruction is given in the practical application of physical laws. Each lecture, so far as possible, is accompanied by practical tests in the lecture room on large-size apparatus, built especially for this course, so that the student may actually see a demonstration of the truth of the various laws, thus enabling him to grasp readily the underlying principles. The course is devoted to a study of the mechanics of solids, liquids and gases, heat and its effects, together with lectures on light and sound. Practical problems covering each phase of the work are given throughout the year, which are designed to fix in the student's mind the fundamental principles taken up in the lectures.

9. Practical Physics Problems

Preparation: 8

This course is taken by all regular students taking the course in Practical Physics (8), and is designed to give a more thorough understanding of the application of the principles discussed in the lectures to the solution of problems.

10. Mechanical Drawing

This course is of an elementary character, and is planned on the assumption that the student has had no experience in the use of drawing instruments. Instruction is given in the use of instruments, the T-square, triangles and French curves, and in the fundamental rules for making drawings. Simple geometrical constructions and the principle of orthographic projections are studied.

11. Surveying

Preparation: 4

The first term is devoted to a study of surveying instruments, the methods of making surveys, and the solution of problems in plane surveying.

In the second term, the methods used in topographic surveying, together with the problems relating thereto, are taken up in detail, as well as advanced and special problems in plane surveying. A study is also made of triangulation and barometric leveling.

Special emphasis is laid on the construction and use of the various kinds of maps and plans with which the surveyor should be familiar.

12. Topographical Drawing

Preparation: 10

The first half of the course is devoted to a study of the various conventional symbols used in the drawing of topographical maps. Each student is required to familiarize himself with these symbols and make an inked drawing containing several of them. Reasonable proficiency in the use and application to maps is expected. The latter part of the course is given over to the making of a contour map from field notes, then applying typical problems of earthwork, such as figuring volumes, balancing cuts and fills, grading, etc.

13. Highway Engineering

Preparation: 11

The course is outlined to give the student the principles and practice of modern highway engineering. This is not entirely a lecture course, for much time is given to the discussion and

relative merits of numerous phases of the subject. The first part of the course considers the preliminary investigation, design, drainage, foundations and layout, for gravel, earth and broken stone roads, including the use of bituminous materials. The latter part of the course considers several classes of pavements, including bituminous concrete, bituminous gravel and macadam, asphalt, wood-block, stone block, concrete and brick. Some time is also devoted to studying sidewalks, curbs, bridges, culverts and pipe systems.

14. Railroad Engineering

Preparation: 11

This course consists of instruction in the computation and methods of laying out simple, compound, reverse and easement curves; frogs, switches and turnouts; the computation of earthwork by different methods, slope stakes, borrow pits and cross-section work.

15. Railroad Engineering Drawing

Preparation: 10, 14

From field notes, a map and profile of a preliminary survey for a railroad are plotted, the location is discussed and adjusted to the preliminary map. Other drawings involving the study of problems common to railroad practice are taken up. The course is supplemented by lectures.

16. Practical Mechanics

Preparation: 4, 7, 8

A course of lectures and recitations which comprise a study of the general methods and applications of statics, including the determination of reactions, stresses in frames, of distributed forces and center of gravity, moment of inertia and radius of gyration of plane areas and solids. Kinematics and dynamics are also taken up, including the equations for uniform and varying rectilinear motion, centrifugal force, work, power and kinetic energy.

17. Strength of Materials I

Preparation: 16

This course comprises a study of the strength of materials, mathematically treated. The subjects studied are: the

stresses and strains in bodies subjected to tension, to compression and to shearing; common theory of beams, with thorough discussion of the distribution of stresses, shearing forces and bending moments; longitudinal shear, slopes and deflections, and the strength of shafts and springs.

18. Strength of Materials II

Preparation: 17

This is a continuation of Strength of Materials I in which a study is made of the combined stresses in beams subjected to tension and compression, as well as bending; also of the strength of hooks and columns, the design of riveted joints, and thin, hollow cylinders. A brief consideration of strains, and the relations of the stresses on different planes in a body, and the stresses in simple frames subjected to bending forces, is taken up in the latter part of the course.

19. Structural Drawing

Preparation: 10, 16

The course in structural drawing consists in the working out of various graphical problems of mechanics on the drawing board, drawing standard sections of structural steel shapes, structural details and the preparation of drawings, representing simple structures. The purpose of this course is to familiarize the student with detailed drawings and teach him where and how to dimension structural parts on working drawings.

20. Theory of Structures

Preparation: 18

This course consists of lectures, recitations and solution of problems. Instruction is given in the fundamental theory of structures, including the theory of beams, computation of reactions, moments, and shears for static and moving loads. The work in the classroom is supplemented by the solution of many practical problems in the drawing room.

21. Structural Design

Preparation: 19, 20

The course in structural design consists of work in the drawing room. It is a continuation of the course in structural drawing given in the second year, and includes the execution of elementary structural design, taking up in a practical way

the principles given in the course in Theory of Structures. Each student is given data for various problems, the designs for which he works out in the drawing room, making all necessary computations and executing all drawings necessary for the preparation of a complete design of a number of engineering structures.

22. Mechanical Engineering Drawing

Preparation: 10

This course is a continuation of Mechanical Drawing, and includes problems on the point, line and plane; projections of solids; single and double curved surfaces and their intersections by oblique planes; and practical applications of the principles studied.

The principles of Mechanism are also studied. The problem work takes up the design of pulleys, belts, gearing and gear teeth development, cams and quick return motions used in machine tools such as shapers, slotters and planers.

23. Machine Drawing

Preparation: 10, 22

The aim of this course is to teach the proper way of making the necessary dimensioned drawings for use in practice, good shop systems being adopted. The instruction includes the making of working detail and assembly drawings of machinery from measurements.

24. Machine Design

Preparation: 18, 23

This course aims to give the student practice in the application of theoretical principles previously studied and at the same time acquaint him with the many practical details which must be considered in design work. The problems taken up in the early part of the course are of a static nature, while the later problems involve dynamical stresses. The problems of the course vary from year to year, but the following are typical of the designs taken up: arbor press, hydraulic flanging clamp, crane, air compressor, punch and shear, stone-crusher, etc.

In each design the constructive details are carefully considered, with special attention to methods of manufacture, provision for wear, lubrication, etc. The work is based on rational rather than empirical methods, the student being required to make all calculations for determining the sizes of the various parts and all necessary working drawings.

25. Materials of Construction

Preparation: 8, 16

This course consists of two lectures, or recitations during the first term of the second year, in the study of methods of testing and the strength of various materials used by the engineer. A detailed study is also made of the methods of manufacturing, properties and uses, of materials used in engineering work, such as lime, cement, concrete, brick, wood, stone, iron and steel.

26. Foundations

Preparation: 17, 18

A course covering the method of construction and design of the various kinds of foundations used in engineering construction, together with a study of the bearing power of different kinds of soil.

27. Hydraulics

Preparation: 6, 8

In this course both Hydrostatics and Hydrodynamics are discussed, and many practical problems are solved throughout the work. Under Hydrostatics, the pressures on submerged areas, together with their points of application, are studied; under Hydrodynamics, the flow of water through orifices, short tubes, nozzles, over weirs, and through pipes and open channels is taken up for discussion.

28. Hydraulic Motors

Preparation: 27

A series of exercises, mainly recitations devoted to a study of impulse wheels and reaction turbines, with reference to their proper construction, regulation and testing, and to the

various sources of loss of energy in their operation. Practical problems relating to stream flow, storage and development of water power are considered.

29. Thermodynamics

Preparation: 6, 8

A course in perfect gases and steam including the solutions of general problems and the use of steam and entropy tables. The work covers air compressors, refrigeration, gas engines, steam engines, turbines, and the equipment of a power house, boilers, condensers, and auxiliaries.

30. Direct Currents, Lectures

Preparation: 8

A course of lectures, recitations and problem work during the second year, dealing with the fundamental laws and properties of electric and magnetic circuits. The course is devoted to the study of the principles of direct-current machinery.

31. Direct Currents, Laboratory

Preparation: 30

This course of one evening per week is taken in connection with the corresponding classroom course in Direct Currents, and the experiments performed are intended to illustrate and supplement that work. Each student is required to furnish a complete report, including theory, method of procedure, results and conclusions on each experiment performed by him.

32. Alternating Currents, Lectures

Preparation: 30

A course of lectures, recitations and problem work during the third year, dealing with the principles of electromagnetism, electrostatics, variable currents and harmonic currents including both single-phase and polyphase circuits. A detailed study is made of the construction, theory and application of alternating-current machines.

33. Alternating Currents, Laboratory

Preparation: 31, 32

This course of one evening per week is taken in connection with the corresponding classroom work in alternating currents, and the experiments performed are intended to illustrate and supplement that work. Each student is required to furnish a complete report, including theory, method of procedure, results and conclusions on each experiment performed by him.

34. Inorganic Chemistry

Preparation: 7

A course of experimental lectures on the fundamental laws and principles of inorganic chemistry. The work aims to familiarize the student with the properties and preparation of the following elements and their most important compounds: —oxygen, hydrogen, the halogens, sulphur, nitrogen, phosphorus, carbon, silicon, the alkali and alkaline earth groups, iron and aluminum. The course is to be taken in conjunction with 35.

35. Inorganic Chemistry, Laboratory

Preparation: 34

A laboratory course in which the student is expected to verify and illustrate the facts and principles that have been discussed in the lectures. To be taken in conjunction with 34.

36. Analytical Chemistry, Lectures

Preparation: 34

A practical course in qualitative and quantitative analysis consisting of lectures relating to the separation and indentification of the common metallic elements and the ordinary acids. The latter part of the year will be devoted to lectures and conferences on the fundamental principles of volumetric and gravimetric analysis.

37. Analytical Chemistry, Laboratory

Preparation: 36

This course in the laboratory is devoted to the separation and indentification of common elements and acids in the

laboratory. Each student is required to make a complete analysis of various mixtures, alloys and chemicals used in manufacturing. A study is also made of volumetric determinations involving the use and the standardization of burettes, pipettes and measuring flasks. The work includes alkalimetry, acidimetry, indicators, oxidimetry, iodimetry, chlorimetry.

38. Organic Chemistry

Preparation: 36, 37

The course is devoted to lectures and conferences on the underlying principles and theories of organic chemistry. A detailed study is made of the methods of preparation, and characteristic reactions of the carbon compounds, as illustrated by the methane and benzine derivations.

39. Organic Chemistry, Laboratory

Preparation: 38

In this course the student is required to prepare in the laboratory a number of organic compounds, selected to show the characteristic reactions, and to give training in the practical separation and purification of organic substances. After this synthetic work, the students are given a practical course in organic analysis.

Special Courses

40. Architectural Drawing I

An elementary course, including the fundamental principles underlying all kinds of mechanical and architectural drawing; geometrical problems; orthographic and isometric projections; classical moldings; Roman alphabet and roof problems.

In connection with this course the instructor will outline a course of reading in architectural history.

41. Architectural Drawing II

Preparation: 40

The orders of Architecture. Practical architecture and details of construction. In this course the student is taught the component parts of buildings. Typical details of construction are drawn to a large scale and in isometric projection.

42. Architectural Drawing III

Preparation: 41

This course covers the making of complete plans, elevations and working drawings of some elementary problem.

Special Students

Students desiring special work in Architectural Drawing not outlined above, should consult with the instructor.

43. Radio Communication

This is a lecture course with demonstrations, given three periods per week for fourteen weeks (the course being repeated during the second term of the School), covering the elementary theory of electricity, motors and generators as used in radio working, ether waves, oscillating circuits, transmitting and receiving apparatus, arrangement of circuits, etc., as applied to both telegraphic and telephonic communication.

44. Radio Code and Practice, Elementary

This course is given three evenings per week for fourteen weeks and is repeated during the second term. It is intended for men who have little or no acquaintance with the code, and

aims to bring such men up to a receiving speed of at least fifteen words per minute. A knowledge of the various message forms and regulations is also taught, together with the working of the simple sending and receiving sets.

45. Radio Code and Practice, Advanced

This course is also given three evenings per week for fourteen weeks and is repeated during the second term. It is open only to men who can already receive at the rate of twelve words per minute and is intended to carry them up to a receiving speed of at least twenty-two words per minute. It aims to teach all that is necessary to make them accomplished and skilled operators.

Men taking the elementary course during the first half year and entering this course in the second half should by the end of the year be capable of excellent work.

In these two courses in Radio Code and Practice which are under the supervision of Mr. R. G. Porter, who was on the teaching staff of the U. S. Naval Radio School at Cambridge until its termination, use will be made of the methods of instruction developed by the officers of that school assisted by the Department of Psychology of Harvard University and which have proved exceedingly efficient. A chart of normal progress is mapped out, and each man's progress in receiving is plotted from week to week, so that each man knows whether he is gaining as he should or not, and it can be determined very quickly whether or no he can develop into a speedy operator.

46. Radio Laboratory

This course will be given in connection with the regular courses in electrical laboratory work, and will consist of experiments on motor and generator action, motor control and maintainance storage batteries, etc., covering those special matters which are essential and applicable to the intelligent care and operation of the electrical machines used in transmitting sets.

47. Concrete Construction

A course in the theory and practice of concrete construction. It includes the design of buildings, bridges and va-

rious types of plain and re-inforced concrete structures.

An especially prepared text has been written for this course, in order to meet the demands of men who have not had the advantages of an ideal preparation. This text will be supplemented by lectures, slides and inspection trips of actual work.

EQUIPMENT

The School is now housed in the new building of the Association, and has very exceptionally equipped quarters for carrying on the work of the Engineering Courses.

MECHANICAL ENGINEERING DEPARTMENT

Our steam engineering plant is completely equipped with meters, scales, indicators and all the necessary accessory equipment for making complete boiler tests, and determining the efficiencies of the various appliances used in generating power, heat and light for our new building. This places at the disposal of our classes a perfectly equipped, up-to-date engineering department, and gives them the means of carrying on boiler tests, determining the efficiencies of various fuels and oils, taking indicator diagrams, determining the efficiency of modern reciprocating engines and turbines when direct connected to generators, as well as renders them familiar with all the various auxiliary appliances of such a plant, as condensers, pumps, air compressors, etc. The students also have the use of the equipment of our Automobile School, thus having opportunity to study the most advanced ideas in gasoline engine practice.

CIVIL ENGINEERING DEPARTMENT

Field Instruments

For work in the field the Civil Engineering Department possesses various surveying instruments, representing the principal makes and types of instruments in general use. The

equipment includes transits, levels, compasses, plane table outfits, Locke hand levels, flag poles, leveling rods, stadia rods, engineers' and surveyors' chains, steel and cloth tapes and other accessories. For higher surveying there is an aneroid barometer for barometric leveling, and a sextant reading to ten seconds for hydrographic surveying. The transits are equipped with neutral glasses and reflectors for astronomical observations.

There have recently been added to the equipment a Keuffel & Esser 6¾" transit, a Buff & Buff 4¾" Mountain transit, a Keuffel & Esser 18" Wye level, two surveyors' compasses and a Gurley Electric Current meter for hydraulic measurements, as well as all the miscellaneous apparatus necessary to equip the extra parties that the new instruments would accommodate.

The extent of the equipment and scope of the field work itself are designed to train the student's judgment as to the relative merits of the various types of field instruments.

Design and Drafting Rooms

The School possesses large, light and well-equipped drawing rooms for the carrying on of the designing and drafting, which form so important a part of civil engineering work. These rooms are supplied with lockers containing the drawing supplies, and files containing blue prints and photographs of structures that represent the best practice. Many of the prints and photographs are of structures erected in and about Boston.

ELECTRICAL ENGINEERING DEPARTMENT

Electrical Measurements Laboratory

This is equipped with apparatus fundamentally planned for teaching the principles of measurement, rather than for the precise determination of quantitative results. Nevertheless it is necessary for the proper performance of work in the other laboratory courses that a certain amount of careful quantitative work should be done, and the equipment is being steadily increased and developed with both ends held in view.

Apparatus is available for instruction in the following: Resistance by Ohm's law, substitution and direct reflection, voltmeter methods for high resistance, insulation resistance,

specific resistance, slide wire bridge, Wheatstone bridge, current by electrolysis, electrostatic capacity, inductance, Poggendorf's method of E M F comparison, etc., under the first head, and for work under the second head there is considerable apparatus, among which may be mentioned a conductivity bridge, a Laboratory standard Wheatstone bridge, a Kelvin low-resistance bridge, a Leeds Northrup potentiometer with two standard Weston cells, volt box and steady source of high voltage for voltmeter calibration, numerous standard shunts and a 600 ampere hour storage battery for ammeter calibration, a commutator and leads for use with the Cary-Foster method and a chemical balance.

The Instrument Room is supplied with four General Electric 300-150-15 DC voltmeters, and four double-range Weston's, four single-range ammeters, six millivoltmeters with twelve interchangeable shunts of various ranges up to 100 amperes, all of high grade, together with numerous similar instruments of cheaper quality for lower-class work. For alternating current testing there are:

Three General Electric type P-3 single-phase wattmeters with double voltage and current ranges arranged for Y connection; two polyphase wattmeters of similar type and ranges, one of similar type specially constructed for measurement of core loss, three integrating wattmeters and one rotating standard.

Three 300-volt, three 150-volt and three 50-volt voltmeters.

Three 40-ampere, three 25-ampere, three 15-ampere, three 10-ampere, three 5 ampere and three 1-ampere ammeters, these all being in groups of three for polyphase work; and a laboratory standard AC voltmeter with extension coils.

There is also a considerable amount of auxiliary apparatus such as frequency indicators, synchroscopes and power factor meters.

Electrical Engineering Laboratory

This is equipped with numerous machines of different types, the size and voltage ratings being selected to reduce as much as possible the risk from large voltage and power apparatus, while at the same time availing the student of apparatus of commercial sizes such that the various quantities it is desired to measure will be of reasonable dimensions.

Small machines are used mostly for this reason, and also

because the students in their engineering practice come in contact with the large sized and varied machinery of modern power houses and electrical plants continually.

Among the machines of this department are a pair of specially made matched machines, constructed to operate as single, two or three phase generators or motors, as well as synchronous converters, or double-current generators. On the direct-current side, these machines will operate as shunt, series or compound generators, either two or three-wire, or as shunt, series or compound motors. There is a 15 H.P. Westinghouse compound motor, a 3 K.W. compound generator, a 1 K.W. series generator, a 5 H.P. General Electric interpole motor, a 5 H.P. General Electric series motor, a 4 H.P. shunt motor, two 3 H.P. shunt motors, and a 2 H.P. shunt motor; also a 7½ kv-a. special General Electric alternator driven by a 10 H.P. General Electric interpole motor, and a 5 kv-a. Holtzer-Cabot alternator driven by a 10 H.P. Fort Wayne shunt motor. This last machine has two special rotors, permitting its use as a squirrel-cage or phase-wound, induction motor. In addition, there is a 5 K.W. Holtzer-Cabot three-phase synchronous converter, a 5 H.P. General Electric induction motor, which can be operated two or three phase, a 15 kv-a. three-phase alternator, giving practically a pure sine wave, and three General Electric transformers, each of 3 kv-a. capacity. During the past year there have been added three special 1 K.W. single-phase transformers, with leads arranged to give various types of transformer primary and secondary connections, also a set of reactances for making up three-phase inductive loads with extremely low power factor, and a similar set of condensers.

There is also available for advanced instruction, in co-operation with the Mechanical Engineering Department, the four three-wire generators in the main generating plant. Three of these generators are driven by Ridgeway reciprocating engines and one by a Westinghouse-Parson turbine.

Physics Laboratories

The Physics Department has been very completely equipped with all necessary apparatus for the experimental work that is required of the students, as well as that required for lecture demonstration. There is a large laboratory, together with a lecture room devoted entirely to Physics. Among other things

have been added verniers, levels, spherometers, calorimeters, thermometers, pyrometers, a spectroscope, a microscope, a spectrometer, balances, standard gram weight, lecture table galvanometer, optical disk with all accessories, lenses, photometer, a full set of Weather Bureau apparatus, including a barograph, thermograph, hygrometer, barometer, maximum and minimum thermometers, etc. These, in addition to the equipment already owned, give a wide range to the experimental work that can be done.

Chemical Laboratories

The School has three laboratories completely equipped in all respects for carrying on all lines of chemical work, from that of a high school to that of most advanced college grade. They have accommodations for over one hundred and fifty students, and are suitably furnished with all the necessary appliances for chemical work. Some of these are: hoods, drying closets, a still, steam and hot-water baths, electrolytic circuits, vacuum and pressure apparatus, balances, combustion furnaces, and complete sets of apparatus for the sampling and analysis of flue gases and fuels. There are also testing machines for oils, viscosimeters, and different sorts of flash point apparatus. A chemical museum is connected with this department, where are kept specimens for purposes of illustration.

Libraries

The School shares the privileges of the steadily growing Y.M.C.A. Libraries in the Main Building. It also supports a professional library distributed among the various departments. In addition to this, it subscribes to current periodicals on engineering and scientific subjects for the exclusive use of students. All members of the School are entitled to take books from the Boston Public Library, and this offers a very unusual opportunity to our non-resident students.

Department of Physical Training

Our new gymnasium with all the latest modern equipment gives ample accommodation for all students. There is a running track on the grounds adjoining, together with tennis and hand-ball courts; also a large natatorium where swimming is taught by competent instructors. In connection with this department there are also six excellent bowling alleys, which may be used by the students upon the payment of a nominal fee.

COURSES OF STUDY

Schedule of Engineering Subjects

(Arranged alphabetically by subjects)

Subject Number	*Subject*	*Evenings*	*Time*
1	Algebra	Mon. and Thurs.	7.00-7.45
32	Alternating Currents, Lectures	Mon. and Thurs.	8.30-9.15
33	Alternating Currents, Laboratory	Tues.	7.00-9.15
36	Analytical Chemistry, Lectures	Mon. and Thurs.	7.00-7.45
37	Analytical Chemistry, Laboratory	Mon. and Thurs.	7.45-9.15
		Tues.	7.00-9.15
5	Analytical Geometry	Mon. and Thurs.	8.30-9.15
6	Calculus	Mon. and Thurs.	8.30-9.15
7	Chemical Physics	Mon. and Thurs.	8.30-9.15
30	Direct Currents, Lectures	Mon. and Thurs.	7.00-7.45
31	Direct Currents, Laboratory	Tues.	7.00-9.15
26	Foundations	Mon.	8.30-9.15
2	Geometry	Mon.	7.45-8.30
13	Highway Engineering	Tues.	8.30-9.15
27	Hydraulics	Mon. and Thurs.	7.00-7.45
28	Hydraulic Motors	Mon. and Thurs.	7.00-7.45
34	Inorganic Chemistry, Lectures	Mon. and Thurs.	7.45-8.30
35	Inorganic Chemistry, Laboratory	Wed.	7.00-9.15
3	Logarithms and Slide Rule	Mon.	7.45-8.30
23	Machine Drawing	Tues.	7.00-9.15
24	Machine Design	Tues.	7.00-9.15
25	Materials of Construction	Mon. and Thurs.	7.00-7.45
10	Mechanical Drawing	Wed.	7.00-9.15
22	Mechanical Engineering Drawing	Tues.	7.00-9.15
38	Organic Chemistry, Lectures	Wed.	7.00-8.30
39	Organic Chemistry, Laboratory	Mon. and Tues.	7.00-9.15
16	Practical Mechanics	Mon. and Thurs.	7.45-8.30
8	Practical Physics	Mon. and Thurs.	8.30-9.15
9	Practical Physics Problems	Thurs.	7.45-8.30
14	Railroad Engineering	Mon. and Thurs.	8.30-9.15
15	Railroad Engineering, Drawing	Tues.	7.00-9.15
17	Strength of Materials I	Mon. and Thurs.	7.00-7.45

Subject Number	Subject	Evenings	Time
18	Strength of Materials II	Mon. and Thurs.	8.30-9.15
21	Structural Design	Tues.	7.00-9.15
19	Structural Drawing	Tues.	7.00-9.15
11	Surveying	Mon. and Thurs.	7.00-8.30
20	Theory of Structures	Mon. and Thurs.	7.00-8.30
29	Thermodynamics	Mon. and Thurs.	7.45-8.30
12	Topographical Drawing	Tues.	7.00-8.30
4	Trigonometry	Mon. and Thurs.	7.00-7.45
40	Architectural Drawing I	Fri.	7.00-9.30
41	Architectural Drawing II	Fri.	7.00-9.30
42	Architectural Drawing III	Fri.	7.00-9.30
43	Radio Communication	Mon., Thurs. and Fri.	7.45-8.30
44	Radio Code and Practice (Elementary)	Mon., Thurs. and Fri.	7.00-7.45 and 8.30-9.15
45	Radio Code and Practice (Advanced)	Mon., Thurs. and Fri.	7.00-7.45 and 8.30-9.15
46	Radio Laboratory	By assignment	
47	Concrete Construction	Fri.	7.00-9.15

RATES OF TUITION

Regular Three-Year Courses

The tuition fee for each year of the regular courses shall be sixty (60) dollars, payable as follows:

$30.00 upon entering
$15.00 November 15
$15.00 January 15

The foregoing rates include membership in the Association.

Individual Engineering Subjects

(Arranged alphabetically by subjects)

	Course	*Tuition*
1	Algebra	$10.00
32	Alternating Currents, Lectures	20.00
33	Alternating Currents, Laboratory	30.00
36*	Analytical Chemistry, Lectures	20.00
37*	Analytical Chemistry, Laboratory	70.00
5	Analytical Geometry	10.00
6	Calculus	10.00
7	Chemical Physics	20.00
47	Concrete Construction	20.00
30	Direct Currents, Lectures	20.00
31	Direct Currents, Laboratory	30.00
26	Foundations	10.00
2	Geometry	5.00
13	Highway Engineering	10.00
27	Hydraulics	10.00
28	Hydraulic Motors	10.00
34*	Inorganic Chemistry, Lectures	20.00
35*	Inorganic Chemistry, Laboratory	30.00
3	Logarithms and Slide Rule	5.00
23	Machine Drawing	15.00
24	Machine Design	30.00
25	Materials of Construction	10.00
10	Mechanical Drawing	15.00
22	Mechanical Engineering Drawing	15.00
38*	Organic Chemistry, Lectures	20.00
39*	Organic Chemistry, Laboratory	60.00
16	Practical Mechanics	20.00
8	Practical Physics	20.00
9	Practical Physics Problems	10.00
14	Railroad Engineering	20.00
15	Railroad Engineering Drawing	30.00
17	Strength of Materials I	10.00
18	Strength of Materials II	10.00

	Course	*Tuition*
21	Structural Design	$30.00
19	Structural Drawing	30.00
11	Surveying	40.00
20	Theory of Structures	40.00
29	Thermodynamics	20.00
12	Topographical Drawing	20.00
4	Trigonometry	10.00

*A laboratory fee of five dollars per year will be charged to each student taking courses in the chemical laboratories. In addition, a laboratory deposit of five dollars will be required. This deposit is returnable upon payment of all breakage and other charges.

Special Courses

40	Architectural Drawing I	$15.00
41	Architectural Drawing II	15.00
42	Architectural Drawing III	15.00
43	Radio Communication	15.00
44	Radio Code and Practice (Elementary)	20.00
45	Radio Code and Practice (Advanced)	20.00
46	Radio Laboratory	20.00
47	Concrete Construction	20.00

Special Note.—The above rates are in addition to membership ($2). In case more than one subject is taken, a discount of $3 for each additional subject will be made.

NORTHEASTERN COLLEGE

SCHOOL OF LAW

Evening Sessions

Established in 1898; incorporated in 1904. Provides a four-years' course in preparation for the Bar, and grants the Degree of Bachelor of Laws.

SCHOOL OF COMMERCE AND FINANCE

Evening Sessions

Established in 1907; incorporated in 1911. Offers the following three- and four-year courses leading to the degree of B.C.S. (Bachelor of Commercial Science): Business Administration and Professional Accountancy. Any one passing the examination for advanced standing is enabled to complete any one of the regular courses and secure the degree in three years. Special courses in addition to regular courses.

CO-OPERATIVE SCHOOL OF ENGINEERING

Day Sessions

Four-year courses in Civil, Mechanical, Electrical and Chemical Engineering, in coöperation with engineering firms. Students earn while learning. Open to high school graduates.

EVENING SCHOOL OF ENGINEERING

Evening Sessions

A school offering three-year courses in Civil, Mechanical, Electrical, Chemical and Structural Engineering.

SCHOOL OF LIBERAL ARTS

Evening Sessions

Courses of college grade in English Composition, Literature, Ancient and Modern Languages, Mathematics, History, Economics, Government, Psychology, Logic, Philosophy, Education, Public Speaking, Journalism and others. Professors and instructors of New England colleges are engaged for this work. This school enables young men to pursue in the evening courses of instruction of the same high standard as those conducted by the best day colleges.

For further information concerning any of the above schools or departments, address

NORTHEASTERN COLLEGE

316 Huntington Avenue, Boston, Massachusetts

THE EVENING
SCHOOL OF
ENGINEERING

FOUNDED FOR THE INSTRUCTION
OF MEN IN THE THEORY AND
PRACTICE OF ENGINEERING

Northeastern College

Evening Polytechnic School

1921-22

EVENING SESSIONS

Boston Young Men's Christian Association
316 Huntington Avenue,
Boston 17, : : Massachusetts

NORTHEASTERN COLLEGE
And Affiliated Schools

DAY SCHOOL
School of Engineering

Four-year courses in Civil, Mechanical, Electrical, and Chemical Engineering, leading to the degrees of Bachelor of Civil, Mechanical, Electrical, and Chemical Engineering: B.C.E., B.M.E., etc. The school is conducted in co-operation with engineering firms. Students earn while learning. Open to high school graduates.

Work conducted at Boston.

EVENING SCHOOLS
School of Law

Four-year course leading to the degree of Bachelor of Laws. Complete preparation for the Bar examinations and the practice of Law. Case method of instruction. Day school standards of scholarship. Courses organized for business men who desire a legal training. Open to high school graduates or men with an equivalent education. A limited number of men of maturity and experience admitted each year as special students, not candidates for the LL.B. degree.

Work conducted at Boston and in Divisions at Worcester, Springfield and Providence.

School of Commerce and Finance

Four-year courses in Accountancy, Production, Marketing, Finance and Management, leading to the degrees of Bachelor of Commercial Science and Master of Commercial Science. Complete preparation for certified public account examinations given either by State examiners or by the American Institute of Accountants. Also complete preparation for private accountants and business executives.

Work conducted at Boston and in Divisions or Branches at Worcester, Springfield, Bridgeport, Providence, New Haven, Lynn, Cambridge, Malden and Newton.

AFFILIATED SCHOOLS
Evening Polytechnic School

A school offering three-year college courses in Civil, Mechanical, Electrical, Chemical, Structural, Industrial, and Automotive Engineering, leading to a diploma. The school trains men for positions of trust and responsibility.

Work conducted at Boston and in Divisions at Worcester, Springfield, New Haven and Bridgeport. (The school in Worcester is known as the "Evening School of Applied Science.")

Northeastern Preparatory School

Courses of High School grade in English, Ancient and Modern languages, Mathematics, History, Economics, Government, Chemistry, Physics, Penmanship, Bookkeeping, Shorthand, and Mechanical Drawing. Instructors from High Schools. The school offers facilities for a four-year course in the evening, and is in session for three terms of sixteen weeks each year. It is possible for students to meet college entrance requirements in from three to five years of evening work.

Work conducted at Boston and in Divisions at Worcester and New Haven.

For further information concerning any of the above schools, address

NORTHEASTERN COLLEGE
316 Huntington Avenue, Boston 17, Massachusetts
or nearest division or branch

Northeastern College

Catalog of the Evening Polytechnic School

1921-1922

EVENING SESSIONS

Northeastern College of the Boston Y. M. C. A. is incorporatea under the laws of Massachusetts and is located in Boston. Divisions of the College are conducted in Worcester, Springfield, Bridgeport, Providence and New Haven. Branches are conducted in Lynn, Cambridge, Malden and Newton.

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CALENDAR 1921-22

September 12
Registration Commences

September 19
Opening of First Term

October 12
Columbus Day (School exercises omitted)

November 24
Thanksgiving Day (School exercises omitted)

December 22
End of First Term

December 23—January 2 inclusive
Christmas Recess

January 3
Opening of Second Term

February 22
Washington's Birthday (School exercises omitted)

April 7
End of Second Term

April 8
Close of School

NORTHEASTERN COLLEGE

THE TRUSTEES

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ARTHUR STODDARD JOHNSON

1ST VICE-PRESIDENT
ALBERT HARMON CURTIS

2ND VICE-PRESIDENT
SABIN POND SANGER

3RD VICE-PRESIDENT
WILMAN EDWARD ADAMS

SECRETARY
GALEN DAVID LIGHT

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LEWIS ABBOTT CROSSETT

WILLIAM CONVERSE CHICK
RUSSELL STURGIS CODMAN
HENRY BRADLEY FENNO
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HENRY GARDNER LORD
FRANCIS POPE LUCE
WILLIAM EVERETT MACURDA
JOSEPH GRAFTON MINOT
WALTER BEMIS MOSSMAN
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NORTHEASTERN COLLEGE

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HAROLD KIMBALL ENGLISH
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NORTHEASTERN COLLEGE

OFFICERS OF THE COLLEGE

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GALEN DAVID LIGHT, A.B., *Secretary*

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President of the College

GALEN DAVID LIGHT, A.B.
Secretary of the College

CARL STEPHENS ELL, A.B., M.S.
Dean of the School of Engineering and the Evening Polytechnic School

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Dean of the School of Commerce and Finance

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Superintendent of Secondary Schools

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BOSTON

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Associate Dean

JOHN BUTLER PUGSLEY, A.B.
Registrar

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Mechanical Drawing

CHESTER PACKARD BAKER, B.Ch.E.
Chemical Engineering

PERCY FRANCIS BENEDICT, S.B.
Civil Engineering

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Physics

HENRY DOLLIVER, S.B.
Theory of Structures

PEARL WHITEFIELD DURKEE, S.B.
Electrical Engineering

WALTER CARL EBERHARD, S.B.
Civil Engineering

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Mechanical Engineering

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Civil Engineering

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Physics

VICTOR OLIVER HOMERBERG, P.D., S.B.
Chemical Engineering

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Electrical Engineering

JOHN ROBERT LEIGHTON, B.C.E.
Civil Engineering

ROBERT MAWSON
Mechanical Drawing

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Structural Engineering

ROLAND GUYER PORTER, B.E.E.
Electrical Engineering

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Concrete Construction

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CONTINUED

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Mathematics

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Chemical Engineering

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Architecture

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Chemical Engineering

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Assistant Dean

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Mechanical Engineering

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Mathematics and Physics

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Mechanical Drawing

GLEASON HARVEY MacCOLLOUGH, B.S.
Mechanical Engineering

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Mechanical Drawing

FRED WOODING HUTCHINSON, B.S.
Mathematics

FREDERICK ARTHUR CALKIN
Strength of Materials and Structural Drawing

LYMAN BARTLETT PHELPS, A.B.
Physics and Practical Mechanics

NEW HAVEN DIVISION

LOCAL OFFICERS OF ADMINISTRATION

JOHN ANDRE BRODHEAD, M.E.
Director and Assistant Dean

STAFF OF INSTRUCTION

(TO BE ANNOUNCED)
Mechanical Engineering

(TO BE ANNOUNCED)
Electrical Engineering

(TO BE ANNOUNCED)
Civil Engineering

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Physics and Mathematics

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Machine Design

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Mechanical Drawing

HARRISON EARLE BALDWIN
Architectural Drafting and Mathematics

BRIDGEPORT DIVISION

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Director and Assistant Dean

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Architectural and Structural Drawing

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Physics

SAMUEL HERBERT LORD
Mechanical Drawing

JOHN RAYMOND LOCKHART
Mathematics

WILLIAM SYLVESTER TUTTLE, M.E.
Mathematics

HISTORICAL SKETCH

The incorporation of Northeastern College of the Boston Young Men's Christian Association in March, 1916, marked the culmination of a notable development. The College is not a new institution, but the realization of an ideal carefully worked out and persistently followed for a period of many years. The Boston Young Men's Christian Association, established in 1851, had as one of its first lines of endeavor, evening classes for young men.

It was not, however, until 1896 that the evening school system was placed upon a permanent basis with expert supervision. As courses were being offered in increasingly large numbers, it became evident that a more complete organization should be effected, with the result that the courses were grouped as separate schools, such additional courses being offered as would complete the curricula of the several schools. The School of Law established in 1898 was incorporated in 1904 with degree granting power. The School of Commerce and Finance founded in 1907 was incorporated in 1911, and was given the right to grant the Bachelor and Master of Commercial Science Degrees in the same year. The School of Engineering was opened in 1909, and received in 1920 the right to grant the following degrees: Bachelor of Civil Engineering, Bachelor of Mechanical Engineering, Bachelor of Electrical Engineering, and Bachelor of Chemical Engineering.

Affiliated with the College are the Evening Polytechnic School, the Huntington School for Boys, and the Northeastern Preparatory School. Divisions of the College have been established at Worcester, Springfield, Bridgeport, New Haven, and Providence, offering the complete courses of one or more of the following schools: School of Law, School of Commerce and Finance, or Evening Polytechnic School.

More closely to co-ordinate the work of the divisions and branches throughout New England with the work at Boston, a Regional Committee was organized May 5th, 1920, for the purpose of "promoting, financing, supervising, and developing Divisions and Branches of Northeastern College." This committee is organized so as to insure the most effective and uniform service to all.

EVENING POLYTECHNIC SCHOOL

ESTABLISHED IN WORCESTER AS THE SCHOOL OF APPLIED SCIENCE

The Evening Polytechnic School was founded in 1913. Although many evening technical courses had been offered before, the regular standard curriculums in Engineering consisting of three continuous years of study had not been established. The school now offers seven curriculums in Engineering in addition to special courses. The School is well equipped to carry on the Engineering work; has a faculty consisting of experienced and able engineers and educators; and an enrollment of five hundred students.

DIVISIONS

A Division is a section of the College conducted in a city which pledges to operate the regular three-year program.

The supervision of all Divisions is thorough and effective. The mechanics of supervision is maintained through a Regional Office.

Divisions have been established in the following cities:

Worcester

This Division was organized in May, 1917. The first class was formed in September of the same year. Mechanical, and Industrial curriculums are offered. The first class is to graduate in June, 1921.

The School is conducted in Worcester under the name "Evening School of Applied Science." This change in name does not modify or effect the work offered in Worcester as compared with the other cities.

Springfield

In May, 1919, the Springfield Division was established with classes opening the following September. Mechanical and Structural curriculums are offered.

New Haven

A Board of Guarantors sponsored the establishment of this Division in April, 1920. Civil, Mechanical, Electrical, Structural, and Industrial curriculums are offered.

Bridgeport

This Division was formally established in July, 1920, with the first classes opening in September. At present Mechanical, Structural, and Industrial curriculums are being offered.

GENERAL INFORMATION

Many men in various lines of industry feel the need of special instruction in Engineering, either to advance in their normal occupation, or to enable them to change their positions and get into work of an Engineering nature.

To such men the School offers a wide variety of regular Engineering curriculums, and in addition, special instruction for those who desire it. The Engineering curriculums require attendance three evenings a week, during a period of three years. While only the fundamental subjects are taken up, the curriculums compare very favorably with similar curriculums offered by the good technical schools.

Three-Year Engineering Curriculums

Regular three-year curriculums, leading to a diploma, are offered in the following branches of Engineering:

I Civil Engineering
II Mechanical Engineering
III Electrical Engineering
IV Chemical Engineering
V Structural Engineering
VI Industrial Engineering
VII Automotive Engineering

The above curriculums are offered as follows:

Boston—All curriculums.
Worcester— II, VI.
Springfield—II, V.
New Haven—I, II, III, V, VI.
Bridgeport—II, V, VI.

Special Courses

Special courses are offered by the School, and will be found described in detail in the latter part of this catalog.

Requirements for Admission

The work carried on in the Engineering Courses assumes that the entering student has had previous training in Elementary Algebra to quadratics, Plane Geometry, and has a good ground-work in English. An entering student should have completed at least the equivalent of one or two years' work in a good high school. Those who have completed a full high-school course should be well fitted to carry on the courses and derive the maximum benefit from the work.

Men who have finished grammar school, but who have not had the requisite previous training in Mathematics and English, may attend the

Evening Courses of the Northeastern Preparatory School, and should be able to get the necessary preparation for entrance to the Engineering School in one year.

There are no entrance examinations for entering sudents, but each applicant for admission is required to have an interview with the Dean or Assistant Dean.

The qualifications of each applicant will be ascertained and he will be advised as to just what work he is qualified to undertake.

Should a student prove to be unable to carry on his studies successfully, he may be required to discontinue any subject in which he is deficient, and complete such preparatory work as is deemed necessary, before being re-admitted to the subject in question.

Tuition Fees

For each year of the regular three-year Engineering Courses, the tuition fee in Boston, Worcester, New Haven, and Bridgeport is sixty dollars; in Springfield, seventy-five dollars. The tuition fee includes membership in the Association. This amount is payable as follows:

One-half upon entering the School
One-fourth November 15
One-fourth January 16

The tuition fee for special courses will be found on Page 40.

Refunds

As the College assumes the obligation of carrying the student throughout the year, when the student registers, and as the College provides the instruction and accommodations on a yearly basis, the Committee on Refunds has ruled as follows:

A. Applications for refunds must be presented within sixty days after withdrawal from school.

B. Credits or refunds may be granted only as stated below:

1. The unused portion of the tuition paid by the applicant may be placed in suspense and used at some future time by the applicant to apply upon tuition in any school in Northeastern College, provided it is used within two years. This action is taken providing the reasons as set forth in the application meet with the approval of the Committee on Refunds.
2. Cash refunds may be granted only in cases where students are compelled to withdraw on account of personal illness. The application must be accompanied by a satisfactory certificate from a physician.

Laboratory Fees

All students taking courses in the Chemical and Electrical Laboratories are charged laboratory fees in accordance with the following

rates: Inorganic Chemistry Laboratory (35), $5.00; Analytical Chemistry Laboratory (37), $10.00; Organic Chemistry Laboratory (39), $10.00; Direct Currents Laboratory (31), $5.00; Alternating Currents Laboratory (33), $5.00. These fees are payable in advance and do not cover breakage or destruction of apparatus. They are non-returnable.

An additional chemical laboratory deposit of five dollars must be made before a desk will be assigned to a student. At the close of the school year the cost of equipment, broken by the student or not returnable, will be deducted from this amount and the balance refunded. Students failing to check up their desks upon leaving school will be charged one dollar extra.

Transfers

No student is permitted to transfer from one course to another without consulting the school office beforehand and receiving a transfer order.

Rules of Standing in Scholarship

A student's grade is officially recorded by letters and percentages, as follows:

A, excellent, 90-100 per cent.
B, good, 80-89 per cent.
C, fair, 70-79 per cent.
D, passable, 60-69 per cent.
E, work incomplete or unsatisfactory, 40-59 per cent.
F, complete failure, below 40 per cent.

A mark of E in any particular subject entitles the student to make up the unsatisfactory work, or to take a condition examination. This letter is given for all grades below 60 per cent on intermediate reports.

A mark of F denies the privilege of taking a condition examination, and the whole course must be repeated.

Reports of Standing

An informal report of the students' standing is issued at the end of the first term, and a formal report, covering the year's work, is issued at the close of each year.

Positions Held by Graduates

The graduates of the School are in constant demand, and it may be said that those who complete one of the courses successfully can be sure of desirable employment in their chosen lines.

Naturally the School does not guarantee to place its graduates in positions. This is not necessary since our graduates have no difficulty in finding places for themselves.

Special Students

A special student may take any subject, upon the approval of the Dean, provided he has had the necessary preliminary training.

Scholarships

As an aid to worthy men who desire an education but are unable to pay the tuition fees, a limited number of scholarships in Boston, and New Haven have been provided. Application should be made in writing. Students who can afford to pay are requested not to apply for this privilege.

Diplomas

Upon the satisfactory completion of any of the regular courses, the student is entitled to receive a diploma. A fee of five dollars is required of all candidates for a diploma. This fee must be paid on or before March 1.

CURRICULUMS OF STUDY

GENERAL STATEMENT

The schedules of the various curriculums are given on the following pages. The first-year work of all curriculums is practically the same, with a few exceptions, which are made because of the need of the student for elementary training in his professional subjects.

The school year comprises twenty-eight weeks of class work and examinations. The twenty-eight weeks are divided into two terms of fourteen weeks each. The subjects in the Course Outlines on the following pages have been arranged by terms. Opposite these subjects will be found the number of periods of forty-five minutes each of class, recitation, laboratory or the drawing room work. The number in parenthesis, following the subject, is the number by which that subject is identified in the descriptive matter under "Subjects of Instruction."

When a student elects a curriculum, he is required to complete all subjects in that curriculum in order to receive a diploma. No subject is to be dropped, or omitted, without the consent of the Dean.

I. CIVIL ENGINEERING

The purpose of this curriculum is to give the student an education in those subjects which form the basis of all branches of technical education, and a special training in those subjects comprised under the term "Civil Engineering." It is designed to give the student sound training, both theoretical and practical, in the sciences upon which professional practice is based.

Civil Engineering covers such a broad field that no one can become expert in its whole extent. It includes Topographical Engineering, Municipal Engineering and Railroad Engineering. It covers land surveying, the construction of sewers, waterworks, roads and streets. All these branches of Engineering rest, however, upon a relatively compact body of principles, and in these principles the students are trained by practice in the class room, drawing room and the field.

The curriculum is designed to prepare the young engineer to take up the work of assisting in the location and construction of steam and electric railways, sewerage and water supply systems, etc.

FIRST YEAR, B., N. H.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR, B., N. H.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (6)	2
Surveying (11)	4	Surveying (11)	4
Topographical Drawing (12)	2	Topographical Drawing (12)	2
Highway Engineering (13)	1	Highway Engineering (13)	1

THIRD YEAR, B.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Hydraulics (27)	2	Strength of Materials I (17)	2
Railroad Engineering (14)	2	Railroad Engineering (14)	2
Railroad Engineering Drawing (15)	3	Railroad Engineering Drawing (15)	3

B.—Boston, W.—Worcester, S.—Springfield, N. H.—New Haven, Bpt.—Bridgeport. Key letters indicate what part and where course is given.

II. MECHANICAL ENGINEERING

This curriculum is designed to give a foundation in those fundamental subjects which form the basis for all professional engineering practice, and especially to equip the young engineer with a knowledge of the various phases of Mechanical Engineering. The course embraces instruction by textbook, lecture, and drawing room.

The curriculum affords training in the methods, and gives practice in the process of Construction, which develops in the student the capacity for thinking along mechanical lines, thus enabling him to base all his work upon fundamental principles already learned, rather than upon empirical rules. It gives the student a good theoretical training and meanwhile devotes sufficient time to the practical work, so that he may become a proficient engineer, both in theory and in practice, in the various branches of Mechanical Engineering.

FIRST YEAR, B., W., S., N. H., Bpt.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR, B., W., S., N. H., Bpt.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (6)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Materials of Construction (25)	2	Strength of Materials I (17)	2
Mechanical Engineering Drawing (22)	3	Mechanical Engineering Drawing (22)	3

THIRD YEAR, B., W.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Strength of Materials II (18)	2	Foundations (26)	2
Hydraulics (27)	2	Hydraulic Motors (28)	2
Heat Engineering (29)	2	Heat Engineering (29)	2
Machine Design (24)	3	Machine Design (24)	3

B.—Boston, W.—Worcester, S.—Springfield, N. H.—New Haven, Bpt—Bridgeport. Key letters indicate what part and where course is given.

III. ELECTRICAL ENGINEERING

Electrical Engineering has developed rapidly in recent years, and students are required to have a thorough appreciation of physical theory, as well as a broad working knowledge of Mathematics. It is essential that students planning to take this course should realize the fundamental necessity of obtaining a solid grounding in these subjects.

It is not the purpose of the curriculum to attempt the impossible, to turn out fully trained engineers in the various branches of the science, especially as the electrical engineering field is becoming daily more and more differentiated and specialized. The course is designed rather to lay a broad and thorough foundation for future progress along the lines of work which may particularly appeal to the individual, and give him a good working acquaintance with the essential principles which underlie each of the more specialized branches of professional activity. Parallel with the theoretical work, runs a carefully planned course of laboratory work which is intended to develop the student's powers of planning work for himself.

FIRST YEAR, B., N. H.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR, B., N. H.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (16)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Direct Currents, Lectures (30)	2	Direct Currents, Lectures (30)	2
Direct Currents, Laboratory (31)	3	Direct Currents, Laboratory (31)	3

THIRD YEAR, B.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Alternating Currents, Laboratory (33)	3	Alternating Currents, Lectures (32)	2
Alternating Currents, Lectures (32)	2	Alternating Currents, Laboratory (33)	3
Hydraulics (27)	2	Hydraulic Motors (28)	2
Heat Engineering (29)	2	Heat Engineering (29)	2

B.—Boston, W.—Worcester, S.—Springfield, N. H.—New Haven, Bpt.—Bridgeport. Key letters indicate what part and where course is given.

IV. CHEMICAL ENGINEERING

The great industrial advance of recent years has placed the chemical industry in the front rank of progress. The most potent reason for this may be found in the replacement of the old rule-of-thumb methods with scientific methods.

Owing to keen competition, manufacturers have been compelled to utilize every product of their plants, and this has called for skilled chemical knowledge. The curriculum in Chemical Engineering has for its purpose the training of students competent to take responsible places in the operation of industries based on chemical principles.

During their course many students are employed in chemical industries, such as gas manufacturing plants, chemical engineering companies, etc. They get not only an excellent training in the theory of such work at school, but a knowledge of the commercial side of the industry as well.

The class work includes a training in Inorganic, Analytical, and Organic Chemistry, which is accompanied by appropriate laboratory work.

FIRST YEAR, B.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Chemical Physics (7)	2	Chemical Physics (7)	2
Inorganic Chemistry, Lectures (34)	2	Inorganic Chemistry, Lectures (34)	2
Inorganic Chemistry, Laboratory (35)	3	Inorganic Chemistry, Laboratory (35)	3

SECOND YEAR, B.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Chemistry, Lectures (36)	2	Analytical Chemistry, Lectures (36)	2
Analytical Chemistry, Laboratory (37)	7	Analytical Chemistry, Laboratory (37)	7

THIRD YEAR, B.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Organic Chemistry, Lectures (38)	2	Organic Chemistry, Lectures (38)	2
Organic Chemistry, Laboratory (39)	6	Organic Chemistry, Laboratory (39)	6

B.—Boston, W.—Worcester, S.—Springfield, N. H.—New Haven, Bpt.—Bridgeport. Key letters indicate what part and where course is given.

V. STRUCTURAL ENGINEERING

The purpose of this curriculum is to give the student a special training in those subjects comprised under the term "Structural Engineering." It is designed to give the student sound and thorough training in the science upon which professional practice is based.

Structural Engineering covers such a broad field that no one can become expert in its whole extent. It includes the design and construction of girders, columns, roofs, trusses, arches, bridges, buildings, walks, dams, foundations and all fixed structures and movable bridges. It includes a knowledge of the relative merits of the design and construction of buildings, bridges, and structures composed of different materials used by the engineer, such as concrete, reinforced concrete, timber, cast iron, and steel.

The curriculum is designed to prepare the young engineer to take up the work of assisting in the design and construction of structures; to undertake intelligently supervision of erection work in the field; and general contracting.

FIRST YEAR, B., S., N. H., Bpt.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR, B., S., N. H., Bpt.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (5)	2	Calculus (6)	2
Materials of Construction (25)	2	Strength of Materials I (17)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Structural Drawing (19)	3	Structural Drawing (19)	3

THIRD YEAR, B.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Strength of Materials II (18)	2	Foundations (26)	2
Theory of Structures (20)	4	Theory of Structures (20)	4
Structural Design (21)	3	Structural Design (21)	3

B.—Boston, W.—Worcester, S.—Springfield, N. H.—New Haven, Bpt.—Bridgeport. Key letters indicate what part and where course is given.

VI. INDUSTRIAL ENGINEERING

New England is a great industrial section. The leaders of industry are confronted with numerous industrial Engineering problems. The financial problems involve capitalization and dividends, as the making of money is the object of operating the factory. The physical problems involve the selection of a site for the factory, the source of power, the layout and arrangement of departments, machinery, and storage spaces.

The administration of the factory means the purchase of raw materials, the employing of labor, the actual production of the goods, the office and clerical work, and the marketing of the product.

The training outlined below provides the student with definite knowledge of the interrelations of all the departments of the factory, but is particularly a preparation for the technical positions which occur in many departments of the modern manufacturing plant.

FIRST YEAR, B., W., N. H., Bpt.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR, B., N. H.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Industrial Organization (44)	2	Industrial Organization (44)	2
Analytical Geometry (5)	2	Calculus (6)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
Mechanical Engineering Drawing (22)	3	Mechanical Engineering Drawing (22)	3

THIRD YEAR
(Omitted for year 1921-1922)

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Scientific Management (45)	2	Traffic Management (46)	2
Materials of Construction (25)	2	Strength of Materials I (17)	2
Heat Engineering (29)	2	Heat Engineering (29)	2
Power Applications (43)	3	Power Applications (43)	3

B.—Boston, W.—Worcester, S.—Springfield, N. H.—New Haven, Bpt.—Bridgeport.
Key letters indicate what part and where course is given.

VII. AUTOMOTIVE ENGINEERING

The extraordinary increase in the use of automobiles during the past few years has created a new profession, Automotive Engineering, which, in the opinion of automobile men, is absolutely necessary to the further development of the industry.

This three-year curriculum of study embraces the entire science of the automobile. Proper emphasis is placed on the design and construction of the automobile parts, body, symmetry, upkeep and repair, and management of production factories.

Such a complete curriculum as this is made possible through the co-operation of the Y. M. C. A. Automotive School with the College in furnishing laboratory facilities.

FIRST YEAR, B.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Algebra (1)	2	Trigonometry (4)	2
Geometry (2)	1	Logarithms and Slide Rule (3)	1
Practical Physics (8)	2	Practical Physics (8)	2
Practical Physics Problems (9)	1	Practical Physics Problems (9)	1
Mechanical Drawing (10)	3	Mechanical Drawing (10)	3

SECOND YEAR, B.

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Industrial Organization (44)	2	Industrial Organization (44)	2
Analytical Geometry (5)	2	Calculus (6)	2
Practical Mechanics (16)	2	Practical Mechanics (16)	2
*Motor Car Construction (40)	3	**Motor Laboratory (41)	3

THIRD YEAR
(Omitted for year 1921-1922)

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Scientific Management (45)	2	Traffic Management (46)	2
Materials of Construction (25)	2	Strength of Materials I (17)	2
Heat Engineering (29)	2	Heat Engineering (29)	2
Motor Car Production (42)	3	Motor Car Production (42)	3

* Sixteen consecutive exercises beginning Tuesday, September 20, 1921.

** Sixteen consecutive exercises beginning Tuesday, January 10, 1922.

B.—Boston, W.—Worcester, S.—Springfield, N. H.—New Haven, Bpt.—Bridgeport. Key letters indicate what part and where course is given.

SUBJECTS OF INSTRUCTION

Instruction is given by lectures and recitations, and by practical exercises in the field, the laboratories and the drawing rooms. A great value is set upon the educational effect of these exercises, and they form the foundation of each of the courses. Text-books are used in many subjects, but not in all. In many branches the instruction given differs widely from available text-books and in most of such cases, notes on the lectures and laboratory work are furnished to the students. Besides oral examinations in connection with the ordinary exercises, written examinations are held from time to time.

In the following pages will be found a detailed statement of the scope of the subjects offered in the various courses. The subjects are classified, as far as possible, related studies being arranged in sequence.

The subjects are numbered, or numbered and lettered, for convenience of reference in consulting the various curriculum Schedules.

The requisites for preparation include not only the subjects specified by number, but also those required as a preparation for them. The reason for this is that to carry on properly the more advanced subjects, the student must have become proficient in all the elementary subjects. Some studies, specified as being required in preparation, may be taken simultaneously. The student must complete such subjects before starting on more advanced work.

By careful consideration of the curriculum Schedules, in connection with the following Description of Subjects, the applicant for a special course may select, for the earlier part of that course, such subjects as will enable him to pursue later those more advanced subjects which he may particularly desire.

The topics, included in the list which follows, are subject to change at any time by action of the School authorities.

SYNOPSIS OF SUBJECTS

Regular Courses

1. Algebra

Preparation: Elementary Algebra

This course is taken by all regular students during the first term of the first year and consists of a general review of Algebra up to quadratic equations, and a continuation including quadratic equations, ratio and proportion, variation and the use of formulas, with applications to problems in Physics and Engineering.

2. Geometry

Preparation: Elements of Plane Geometry

This course is taken by all regular students during the first term of the first year. It consists of a rapid review of the useful theorems, with special reference to mensuration.

3. Logarithms and Slide Rule

Preparation: 1

In this course instruction is given in the theory of logarithms with thorough drill in their use, with applications to the solution of exponential equations, especially in formulas; the theory and use of Slide Rules, including a general discussion of precision and rules for significant figures.

4. Trigonometry

Preparation: 1, 2, 3

This course consists of lectures and recitations covering radians, co-ordinates, trigonometric ratios, formulas, law of sines, law of cosines, solution of right and oblique triangles, with applications to problems in Engineering.

5. Analytical Geometry

Preparation: 4

In this course instruction is given by lectures and recitations in the following subjects: Plotting of functions, interpolation, the straight line, the conic sections, curves represented by various equations of common occurrence in engineering, graphic solution of equations, determination of laws from the data of experiments, simplification of formulas.

6. Calculus

Preparation: 4 and 5

This course is taken by all regular engineering students during the second term of the second year. Instruction is given by lectures and recitations in the following subjects: rate of change, differentiation, maximum and minimum, integration, definite integrals, with application to the determination of mean value, area, volume, center of gravity and moment of inertia.

7. Chemical Physics

This is a course of experimental lectures and exercises, designed especially for students of Chemistry. The work is devoted to a study of the mechanics of solids, liquids, and gases; heat and its effects; and elementary electricity. The problems are planned to give drill work in Mathematics in its applications to Physics and Chemistry.

8. Practical Physics

Preparation: 1, 2

This course consists of two lectures per week throughout the first year. Instruction is given in the practical application of physical laws. Each lecture, so far as possible, is accompanied by practical tests in the lecture room on large-size apparatus, built especially for this course, so that the student may actually see a demonstration of the truth of the various laws, thus enabling him to grasp readily the

underlying principles. The course is devoted to a study of the mechanics of solids, liquids, and gases, heat and its effects, together with lectures on light and sound. Practical problems covering each phase of the work are given throughout the year, which are designed to fix in the student's mind the fundamental principles taken up in the lectures.

9. Practical Physics Problems
Preparation: 8

This course is taken by all regular students taking the course in Practical Physics (8), and is designed to give a more thorough understanding of the application of the principles discussed in the lectures to the solution of problems.

10. Mechanical Drawing

This course is of an elementary character, and is planned on the assumption that the student has had no experience in the use of drawing instruments. Instruction is given in the use of instruments, the T-square, triangles, and French curves, and in the fundamental rules for making drawings. Simple geometrical constructions and the principle of orthographic projections are studied.

11. Surveying
Preparation: 4

The first term is devoted to a study of surveying instruments, the methods of making surveys, and the solution of problems in plane surveying.

In the second term, the methods used in topographic surveying, together with the problems relating thereto, are taken up in detail, as well as advanced and special problems in plane surveying. A study is also made of triangulation and barometric leveling.

Special emphasis is laid on the construction and use of the various kinds of maps and plans with which the surveyor should be familiar.

12. Topographical Drawing
Preparation: 10

The first half of the course is devoted to a study of the various conventional symbols used in the drawing of topographical maps. Each student is required to familiarize himself with these symbols and make an inked drawing containing several of them. Reasonable proficiency in the use and application to maps is expected. The latter part of the course is given over to the making of a contour map from field notes, then applying typical problems of earthwork, such as figuring volumes, balancing cuts and fills, grading, etc.

13. Highway Engineering
Preparation: 11

The course is outlined to give the student the principles and practice of modern highway engineering. This is not entirely a lecture course, for much time is given to the discussion of the relative merits of

numerous phases of the subject. The first part of the course considers the preliminary investigation, design, drainage, foundations, and layout, for gravel, earth and broken stone roads, including the use of bituminous materials. The latter part of the course considers several classes of pavements, including bituminous concrete, bituminous gravel, and macadam, asphalt, wood-block, stone block, concrete, and brick. Some time is devoted to studying sidewalks, curbs, bridges, culverts and pipe systems.

14. Railroad Engineering
Preparation: 11

This course consists of instruction in the computation and methods of laying out simple, compound, reverse, and easement curves; frogs, switches, and turnouts; the computation of earthwork by different methods, slope stakes, borrow pits, and cross-section work.

15. Railroad Engineering Drawing
Preparation: 10, 14

From field notes, a map and profile of a preliminary survey for a railroad are plotted, the location is discussed and adjusted to the preliminary map. Other drawings involving the study of problems common to railroad practice are taken up. The course is supplemented by lectures.

16. Practical Mechanics
Preparation: 4, 8, 9

A course of lectures and recitations which comprise a study of the general methods and applications of statics, including the determination of reactions, stresses in frames, of distributed forces and center of gravity, moment of inertia and radius of gyration of plane areas and solids. Kinematics and dynamics are also taken up, including the equations for uniform and varying rectilinear motion, centrifugal force, work, power and kinetic energy.

17. Strength of Materials I
Preparation: 16

This course comprises a study of the strength of materials, mathematically treated. The subjects studied are the stresses and strains in bodies subjected to tension, to compression and to shearing; common theory of beams, with thorough discussion of the distribution of stresses, shearing forces and bending moments; longitudinal shear; slope and deflection.

18. Strength of Materials II
Preparation: 17

This is a continuation of Strength of Materials I in which a study is made of the strength of shafts and springs; combined stresses in beams subjected to tension and compression, as well as bending; also of the strength of hooks and columns, the design of riveted joints,

and thin, hollow cylinders. A brief consideration of strains, and the relations of the stresses on different planes in a body, and the stresses in simple frames subjected to bending forces, is taken up in the latter part of the course.

19. Structural Drawing
Preparation: 10, 16

The course in structural drawing consists in the working out of various graphical problems of mechanics on the drawing board, drawing standard sections of structural steel shapes, structural details and the preparation of drawings, representing simple structures. The purpose of this course is to familiarize the student with detailed drawings and teach him where and how to dimension structural parts on working drawings.

20. Theory of Structures
Preparation: 18

This course consists of lectures, recitations and solution of problems. Instruction is given in the fundamental theory of structures, including the theory of beams, computation of reactions, moments, and shears for static and moving loads. The work in the class room is supplemented by the solution of many practical problems in the drawing room.

21. Structural Design
Preparation: 19, 20

The course in structural design consists of work in the drawing room. It is a continuation of the course in structural drawing given in the second year, and includes the execution of elementary structural design, taking up in a practical way the principles of the course in Theory of Structures. Each student is given data for various problems, the designs for which he works out in the drawing room, making all necessary computations and executing all drawings necessary for the preparation of complete designs of a number of engineering structures.

22. Mechanical Engineering Drawing
Preparation: 10

This course is a continuation of Mechanical Drawing, and includes problems on the point, line, and plane; projections of solids; single and doubled curved surfaces and their intersections by oblique planes; and practical applications of the principles studied.

The principles of Mechanism are studied. The problem work takes up the design of pulleys, belts, gearing and gear teeth development, cams and quick return motions used in machine tool such as shapers, slotters, and planers.

24. Machine Design
Preparation: 18, 22

This course aims to give the student practice in the application of theoretical principles previously studied and at the same time acquaint

him with the many practical details which must be considered in design work. The problems taken up in the early part of the course are of a static nature, while the later problems involve dynamical stresses. The problems of the course vary from year to year, but the following are typical of the designs taken up; arbor press, hydraulic flanging clamp, crane, air compressor, punch and shear, stone-crusher, etc.

In each design the constructive details are carefully considered, with special attention to methods of manufacture, provision for wear, lubrication, etc. The work is based on rational rather than on empirical methods, the student being required to make all calculations for determining the sizes of the various parts and all necessary working drawings.

25. Materials of Construction
Preparation: 8, 16

This course consists of two lectures or recitations per week during the first term of the second year, in the study of methods of testing and the strength of various materials used by the engineer. A detailed study is made of the methods of manufacturing, properties and uses, of materials used in engineering work, such as lime, cement, concrete, brick, wood, stone, iron and steel.

26. Foundations
Preparation: 17, 18

A course covering the method of construction and design of the various kinds of foundations used in engineering construction, together with a study of the bearing power of different kinds of soil.

27. Hydraulics
Preparation: 6, 8

In this course both Hydrostatics and Hydrodynamics are discussed, and many practical problems are solved throughout the work. Under Hydrostatics, the pressures on submerged areas, together with their points of application, are studied; under Hydrodynamics, the flow of water through orifices, short tubes, nozzles, over weirs, and through pipes and open channels is taken up for discussion.

28. Hydraulic Motors
Preparation: 27

A series of exercises, mainly recitations devoted to a study of impulse wheels and reaction turbines, with reference to their proper construction, regulation, and testing, and to the various sources of loss of energy in their operation. Practical problems relating to stream flow, storage and development of water power are considered.

29. Heat Engineering
Preparation: 6, 8

A course in perfect gases and steam including the solutions of general problems and the use of steam and entropy tables. The work

covers air compressors, refrigeration, gas engines, steam engines, turbines, and the equipment of a power house, boilers, condensers, and auxiliaries.

30. Direct Currents, Lectures
Preparation: 8

A course of lectures, rectations, and problem work during the second year, dealing with the fundamental laws and properties of electric and magnetic circuits. The course is devoted to the study of the principles of direct-current machinery.

31. Direct Currents, Laboratory
Preparation: 30

This course of one evening per week is taken in connection with the corresponding classroom course in Direct Currents, and the experiments performed are intended to illustrate and supplement that work. Each student is required to furnish a complete report, including theory, method of procedure, results and conclusions on each experiment performed by him.

32. Alternating Currents, Lectures
Preparation: 30

A course of lectures, recitations and problem work during the third year, dealing with the principles of electromagnetism, electrostatics, variable currents, and harmonic currents including both single-phase and polyphase circuits. A detailed study is made of the construction, theory and application of alternating-current machines.

33. Alternating Currents, Laboratory
Preparation: 31, 32

This course of one evening per week is taken in connection with the corresponding classroom work in alternating currents, and the experiments performed are intended to illustrate and supplement that work. Each student is required to furnish a complete report, including theory, method of procedure, results, and conclusions on each experiment performed by him.

34. Inorganic Chemistry
Preparation: 7

A course of experimental lectures on the fundamental laws and principles of inorganic chemistry. The work aims to familiarize the student with the properties and preparation of the following elements and their most important compounds:—oxygen, hydrogen, the halogens, sulphur, nitrogen, phosphorus, carbon, silicon, the alkali and alkaline earth groups, iron and aluminum. The course is to be taken in conjunction with 35.

35. Inorganic Chemistry, Laboratory
Preparation: 34

A laboratory course in which the student is expected to verify and illustrate the facts and principles that have been discussed in the lectures. To be taken in conjunction with 34.

36. Analytical Chemistry, Lectures
Preparation: 34

A practical course in qualitative and quantitative analysis consisting of lectures relating to the separation and indentification of the common metallic elements and the ordinary acids. The latter part of the year will be devoted to lectures and conferences on the fundamental principles of volumetric and gravimetric analysis.

37. Analytical Chemistry, Laboratory
Preparation: 36

This course in the laboratory is devoted to the separation and indentification of common elements and acids in the laboratory. Each student is required to make a complete analysis of various mixtures, alloys and chemicals used in manufacturing. A study is also made of volumetric determinations involving the use and the standardization of burettes, pipettes and measuring flasks. The work includes alkalimetry, acidimetry, indicators, oxidimetry, iodimetry, chlorimetry.

38. Organic Chemistry
Preparation: 36, 37

The course is devoted to lectures and conferences on the underlying principles and theories of organic chemistry. A detailed study is made of the methods of preparation, and characteristic reactions of the carbon compounds, as illustrated by the methane and benzine derivations.

39. Organic Chemistry, Laboratory
Preparation: 38

In this course the student is required to prepare in the laboratory a number of organic compounds, selected to show the characteristic reactions, and to give training in the practical separation and purification of organic substances. After this synthetic work, the students are given a practical course in organic analysis.

40. Motor Car Construction

A lecture course of sixteen consecutive lectures given in co-operation with the Automotive School. This course covers the essentials of Autimobile Maintenance and repair, including ignition, starting and lighting, carburetion, cooling and oiling systems, tire work, transmissions, and differentials.

41. Motor Laboratory
Preparation: 40

This course contains sixteen consecutive shop exercises in general repairing, overhauling, replacing of parts, and common adjusting; beginning Tuesday, January 10, 1922, and continuing beyond the regular closing period of the school in April.

42. Motor Car Production

The principles involved in the installation and management of an automobile manufacturing establishment. A study of the organization of the various departments essential to the production, marketing and

maintenance of the automobile. This course includes lectures on the design of various types of cars, of automobile bodies, chasses and motors, the important points to be considered in the efficient production of the various parts and the assembling of the complete machine, together with a study of the maintenance of adequate service stations.

43. Power Applications

The course in Power Applications is devoted largely to a description of the many appliances used in modern power plants and in manufacturing establishments. A study is made of boilers, boiler accessories, electrical motors and generators and various types of gas engines. The aim of the course is to familiarize the student with the various kinds of appliances for using power that he may be able clearly to determine the advantages or disadvantages of using certain appliances in any given case. Considerable time is devoted to the consideration of the electrical appliances.

44. Industrial Organization

A treatment of the financial problems of the manufacturing plant including its relations with banks and stock exchanges, and the corporation laws of various states. Time is devoted to the types of building construction suitable for various kinds of factories, the layout of shafting and power, equipment of offices, and natural and artificial lighting. Another topic deals with the department for selling and advertising technical products.

45. Scientific Management

An analysis of production control, time and motion study, stores and supply systems and cost problems.

46. Traffic Management

This covers the shipping of the product after the manufacturing is complete, including the range of usefulness of the motor truck, and the classification of the freight rates on the railroads.

Special Courses

47. Architectural Drawing I—B., N. H., Bpt.

An elementary course, including the fundamental principles underlying all kinds of mechanical and architectural drawing; geometrical problems; orthographic and isometric projections; classical moldings; Roman alphabet and roof problems.

In connection with this course the instructor will outline a course of reading in architectural history.

48. Architectural Drawing II—B., N. H., Bpt.
Preparation: 47

The orders of Architecture. Practical architecture and details of construction. In this course the student is taught the component parts of buildings. Typical details of construction are drawn to a large scale and in isometric projection.

49. Architectural Drawing III—B., N. H., Bpt.
Preparation: 48

This course covers the making of complete plans, elevations and working drawings of some elementary problem.

Special Students

Students desiring special work in Architectural Drawing not outlined above, should consult with the instructor.

50. Concrete Construction—B., Bpt.

A course in the theory and practice of concrete construction. It includes the design of buildings, bridges, and various types of plain and re-inforced concrete structures.

An especially prepared text has been written for this course, in order to meet the demands of men who have not had the advantages of an ideal preparation. This text will be supplemented by lectures, slides, and inspection trips of actual work.

B.—Boston, W.—Worcester, S.—Springfield, N. H.—New Haven, Bpt.—Bridgeport. Key letters indicate what part and where course is given.

ENGINEERING EQUIPMENT

The Schools in Boston and the Divisions are housed in buildings of the Association. In Boston the School also occupies the Gainsborough Building and the Vocational Bulding.

The equipment available for the use of the Boston School includes:

36 Class Rooms
5 Drawing Rooms
3 Chemical Laboratories
1 Electrical Engineering Laboratory
1 Electrical Measurements Laboratory
1 Mechanical Engineering Laboratory
2 Physics Laboratories
Civil Engineering Equipment
2 Libraries
3 Social Rooms
3 Game Rooms
3 Gymnasiums
1 Swimming Pool
2 Large Halls
8 Offices and Equipment

Equipment in the Divisions at Worcester, Springfield, New Haven, and Bridgeport is being provided as required for the courses given in those cities. In each Division, the equipment is not as extensive as that of the Boston School, owing to a smaller student body, but is adequate for the successful and thorough conduct of the work.

The following described equipment is available for the Boston School:

Mechanical Laboratories

The steam power plant is completely equipped with meters, scales, indicators, Orsat apparatus for flue gas analysis, and all other equipment necessary for making complete power plant tests. The plant consists of four horizontal-return tubular boilers, two of which are equipped for burning fuel oil and two for burning coal; and four three wire generators, of which, three are driven by Ridgway reciprocating steam engines of various sizes, and the other is connected direct to a Westinghouse-Parsons turbine. This places at the disposal of our classes a perfectly equipped, up-to-date, engineering laboratory, and gives them the means of carrying on boiler tests, determining the efficiencies of various fuels and oils, taking indicator diagrams, determining the efficiency of modern reciprocating engines and turbines when connected direct to generators.

The students have the use of the equipment of our Automobile School, and they thus have an opportunity to study the most advanced ideas in gasoline engine practice.

Field Instruments of Civil Engineering

For work in the field, the Civil Engineering Department possesses various surveying instruments, representing the principal makes and types in general use. The equipment includes two Keuffel & Esser transits, two Buff & Buff transits, two Berger levels, two other levels, and three plane table outfits. There are Locke hand levels, flag poles, leveling rods, stadia rods, engineers' and surveyors' chains, steel and

cloth tapes, and all the miscellaneous equipment necessary to outfit the parties that the instruments will accommodate. The transits are equipped with neutral glasses and reflectors for astronomical observations. For higher surveying there is an aneroid barometer for barometric leveling, a sextant for hydrographic surveying, and a Gurley Electric Current meter for hydraulic measurements.

The extent of the equipment and scope of the field work itself are designed to train the student's judgment as to the relative merits of the various types of field instruments.

Design and Drafting Rooms

The School possesses large, light, and well-equipped drawing rooms for the carrying on of the designing and drafting which form so important a part of engineering work. These rooms are supplied with lockers containing the drawing supplies, and files containing blue prints and photographs of machines and structures that represent the best practice.

Electrical Measurements Laboratory

The laboratory was entirely rebuilt during the summer of 1920. It is equipped with apparatus fundamentally planned for teaching the principles of measurement, rather than for the precise determination of quantitative results. Nevertheless it is necessary for the proper performance of work in the other laboratory courses that a certain amount of careful quantitative work should be done, and the equipment is being steadily increased and developed with both ends held in view.

A partial list of the apparatus available for instruction is the following. Under the first head, resistance by Ohm's law, substitution and direct reflection, voltmeter methods for high resistance, insulation resistance, specific resistance, slide wire bridge, electrostatic capacity, inductance, Poggendorf's method of E. M. F. comparison. Under the second head, a Laboratory standard Wheatstone Bridge, a Kelvin low resistance bridge, a Leeds Northrup potentiometer with two standard Weston cells, volt box and steady source of high voltage for voltmeter calibration, a commutator and leads for use with the Cary-Foster method, and a chemical balance.

The instrument room is supplied with 18 high grade G. E. and Weston ammeters and voltmeters of various sizes for D. C. work, together with numerous similar instruments of cheaper quality for lower class work.

For A. C. testing, there are 27 voltmeters and ammeters of various sizes arranged in groups of three for polyphase work, and 8 single or three phase wattmeters.

There is also a considerable amount of auxiliary apparatus such as frequency indicators, synchroscopes, and power factor meters.

Electrical Engineering Laboratory

The Laboratory was entirely remodeled during the summer of 1920. It is equipped with numerous machines of different types, the size and voltage ratings being selected to reduce as much as possible the risk from large voltage and power apparatus, while at the same time making available to the student commercial apparatus such that the various quantities it is desired to measure will be of reasonable dimensions.

Moderate-sized machines are used principally for this reason but also because the students in their Engineering Practice come into contact with the large-sized and varied machinery of modern power houses and electrical plants generally.

Among the machines of this department are a pair of matched Holtzer-Cabot 5 kv-a synchronous converters, specially planned to operate as 3 phase generators, motors or double current generators. They are driven independently by 10 HP 220 volt General Electric interpole motors, and may also be mechanically coupled for certain work.

There is also a pair of matched and specially designed direct current generators of 6 kilowatt rating at 220 volts, which may be operated either shunt or compound, driven by a 15 kilowatt interpole Sprague motor with double extended shaft. These machines are particularly intended for work on characteristics and parallel operation, but may also be coupled so as to be available in the various "pumping back" methods of testing.

Alternating current is supplied by a three phase General Electric 15 kv-a alternator, giving practically a pure sine wave, driven by a 20 kw Westinghouse motor; there is also a 7.5 kv-a General Electric alternator driven from a 15 HP Sprague motor, fitted with taps from each armature coil, a 5 kv-a Holtzer-Cabot machine with two spare rotors making it available either as a generator, synchronous motor, squirrel cage or phase wound induction motor; and a dozen or so more motors and generators of various sizes and types.

There are two sets of G. E. type H transformers, three to the set, of 3 kv-a rating with primary voltage of 550 and secondary of 220-110, which may be used for transmission experiments as well as ordinary testing, and a very considerable assortment of variable ratio transformers, reactances, condensers, and similar control and testing apparatus aside from the very complete line of instruments belonging to the Electrical Measurements Laboratory.

Physics Laboratories

The Physics department has been completely equipped with all necessary apparatus for the experimental work that is required of the

students, as well as that required for lecture demonstration. There are two large laboratories together with a lecture room devoted to Physics. The apparatus and equipment includes verniers, levels, a vacuum pump, planimeters, spherometers, calorimeters, thermometers, a pyrometer, a sonometer, a spectroscope, a spectrometer, balances, standard gram weight, lecture table galvanometer, optical disk with all accessories, lenses, photometer, an air thermometer, a full set of Weather Bureau apparatus, including a barograph, thermograph, hygrometer, barometer, maximum and minimum thermometers, etc. These give a wide range to the experimental work that can be done.

Chemical Laboratories

The School has three laboratories completely equipped in all respects for carrying on all lines of chemical work, from that of a high school to that of most advanced college grade. There are accommodations for over one hundred and fifty students, and are suitably furnished with all the necessary appliances for chemical work. Some of these are hoods, drying closets, a still, steam and hot water baths, electrolytic circuits, vacuum and pressure apparatus, balances, combustion furnaces, and complete sets of apparatus for the sampling and analysis of flue gases and fuels. There are also testing machines for oils, viscosimeters, and different sorts of flash point apparatus. A chemical museum is connected with this department where are kept specimens for purposes of illustration.

Libraries

The Boston School shares the privileges of the steadily growing Libraries in the Main Building, to which have been added more than a $1000 worth of engineering texts purchased for the School. In addition to this, it subscribes to current periodicals on engineering and scientific subjects for the exclusive use of students. All members of the School are entitled to take books from the Boston Public Library, and this offers a very unusual opportunity to the non-resident students

In the Divisions arrangements are made for the use of the Public Libraries. In some cases reference books are being provided at the School for the use of the students.

Department of Physical Training

Northeastern is one of the colleges having facilities for all-round physical training. Each building in which the School is conducted is equipped with unexcelled facilities for physical training. Students are urged to avail themselves of these privileges, which can be obtained for a small fee each year. It is vitally important that men who are employed during the day and studying at night take some form of bodily and recreational exercise in order that they may do the most effective school work.

COURSES OF STUDY

Schedule of Engineering Subjects

(Arranged alphabetically by subjects)

Subject Number	*Subject*	*Evenings*	*†B.,W.&S. **Time*
1*	Algebra	Mon. and Thurs.	7:00-7:45
32	Alternating Currents, Lectures	Mon. and Thurs.	8:30-9:15
33	Alternating Currents, Laboratory	Tues.	7:00-9:15
36	Analytical Chemistry, Lectures	Mon. and Thurs.	7:00-7:45
37	Analytical Chemistry, Laboratory	Mon. and Thurs.	7:45-9:15
		Tues.	7:00-9:15
5	Analytical Geometry	Mon. and Thurs.	8:30-9:15
6	Calculus	Mon. and Thurs.	8:30-9:15
7	Chemical Physics	Mon. and Thurs.	7:00-7:45
30	Direct Currents, Lectures	Mon. and Thurs.	7:00-7:45
31	Direct Currents, Laboratory	Tues.	7:00-9:15
26	Foundations	Mon. and Thurs.	8:30-9:15
2	Geometry	Mon.	8:30-9:15
29	Heat Engineering	Mon. and Thurs.	7:45-8:30
13	Highway Engineering	Tues.	8:30-9:15
27	Hydraulics	Mon. and Thurs.	7:00-7:45
28	Hydraulic Motors	Mon. and Thurs.	7:00-7:45
44	Industrial Organization	Mon. and Thurs.	7:00-7:45
34	Inorganic Chemistry, Lectures	Mon. and Thurs.	7:45-8:30
35	Inorganic Chemistry, Laboratory	Wed.	7:00-9:15
3	Logarithms and Slide Rule	Mon.	8:30-9:15
24	Machine Design	Tues.	7:00-9:15
25	Materials of Construction	Mon. and Thurs.	7:00-7:45
10	Mechanical Drawing	Wed.	7:00-9:15
22	Mechanical Engineering Drawing	Tues.	7:00-9:15
40	Motor Car Construction	Tues.	7:00-9:00
41	Motor Laboratory	Tues.	7:00-9:00
42	Motor Car Production	Tues.	7:00-9:15
38	Organic Chemistry, Lectures	Wed.	7:00-8:30
39	Organic Chemistry, Laboratory	Mon. and Tues.	7:00-9:15
43	Power Applications	Tues.	7:00-9:15
16	Practical Mechanics	Mon. and Thurs.	7:45-8:30
8	Practical Physics	Mon. and Thurs.	7:45-8:30
9	Practical Physics Problems	Thurs.	8:30-9:15
14	Railroad Engineering	Mon. and Thurs.	8:30-9:15
15	Railroad Engineering, Drawing	Tues.	7:00-9:15
45	Scientific Management	Mon. and Thurs.	8:30-9:15
17	Strength of Materials I	Mon. and Thurs.	7:00-7:45
18	Strength of Materials II	Mon. and Thurs.	8:30-9:15
21	Structural Design	Tues.	7:00-9:15

SCHEDULE OF ENGINEERING SUBJECTS
CONTINUED

Subject Number	*Subject*	*Evenings*	†*B.,W.&S.* ***Time**
19	Structural Drawing	Tues.	7:00-9:15
11	Surveying	Mon. and Thurs.	7:00-8:30
20	Theory of Structures	Mon. and Thurs.	7:00-8:30
12	Topographical Drawing	Tues.	7:00-8:30
46	Traffic Management	Mon. and Thurs.	8:30-9:15
4	Trigonometry	Mon. and Thurs.	7:00-7:45
47	Architectural Drawing I	Mon.	7:00-9:30
48	Architectural Drawing II	Mon.	7:00-9:30
49	Architectural Drawing III	Mon.	7:00-9:30
50	Concrete Construction	Tues.	7:00-9:15

†*These letters indicate that in Boston, Worcester and Springfield classes begin as shown in Schedule.*

**8.30-9 15 for Course IV in Boston.*

***All classes in New Haven and Bridgeport begin 15 minutes later than time shown in this Schedule.*

RATES OF TUITION

Regular Three-Year Courses

Tuition fee for each year of the regular curriculums in Boston, Worcester, New Haven and Bridgeport is sixty dollars; and in Springfield, seventy-five dollars; payable as follows:

One-half upon entering
One-fourth November 15
One-fourth January 16

The foregoing rates include membership in the Young Men's Christian Association.

Individual Engineering Subjects

(Arranged alphabetically by subjects)

	Course	*Tuition*	
		S. B.,W.,N.H. & Bpt.	
1	Algebra	$12.00	$10.00
32	Alternating Currents, Lectures	25.00	20.00
33	Alternating Currents, Laboratory	37.00	30.00
36*	Analytical Chemistry, Lectures		20.00
37*	Analytical Chemistry, Laboratory		70.00
5	Analytical Geometry	12.00	10.00
6	Calculus	12.00	10.00
7	Chemical Physics		20.00
47	Concrete Construction		20.00
30	Direct Currents, Lectures	25.00	20.00
31	Direct Currents, Laboratory	37.00	30.00
26	Foundations		10.00
2	Geometry	6.00	5.00
29	Heat Engineering		20.00
13	Highway Engineering	12.00	10.00
27	Hydraulics	12.00	10.00
28	Hydraulic Motors	12.00	10.00
44	Industrial Organization		20.00
34*	Inorganic Chemistry, Lectures		20.00
35*	Inorganic Chemistry, Laboratory		30.00
3	Logarithms and Slide Rule	6.00	5.00
24	Machine Design	37.00	30.00
25	Materials of Construction	12.00	10.00
10	Mechanical Drawing	18.00	20.00
22	Mechanical Engineering Drawing	18.00	30.00
40	Motor Car Construction		15.00
41	Motor Laboratory		15.00
42	Motor Car Production		30.00
43	Power Applications		30.00
38*	Organic Chemistry, Lectures		20.00
39*	Organic Chemistry, Laboratory		60.00
16	Practical Mechanics	25.00	20.00

INDIVIDUAL ENGINEERING SUBJECTS
CONTINUED

	Course	*Tuition*		
		S. B.,W.,N.H. & Bpt.		
8	Practical Physics	25.00	.....	20.00
9	Practical Physics Problems	12.00	.....	10.00
14	Railroad Engineering	25.00	.....	20.00
15	Railroad Engineering Drawing	37.00	.....	30.00
45	Scientific Management		.....	10.00
17	Strength of Materials I	12.00	.....	10.00
18	Strength of Materials II	12.00	.....	10.00
21	Structural Design	37.00	.....	30.00
19	Structural Drawing	37.00	.....	30.00
11	Surveying	48.00	.....	40.00
20	Theory of Structures	48.00	.....	40.00
12	Topographical Drawing	25.00	.....	20.00
46	Traffic Management		.....	10.00
4	Trigonometry	12.09	.....	10.00
		B.,N.H.,Bpt.		
47	Architectural Drawing I	$15.00		
48	Architectural Drawing II	15.00		
49	Architectural Drawing III	15.00		
50	Concrete Construction	20.00		

* See Catalog statement in regard to fees.

Special Note.—In case more than one subject is taken, a discount of $3 for each additional subject will be made.

The individual rates above are in addition to membership in the Y. M. C. A.

B.—Boston, *S.—Springfield, W.—Worcester, N. H.—New Haven, Bpt.—Bridgeport. Key letters at head of columns indicate cities where listed fees are charged.*

Northeastern University

Evening Polytechnic School

1922-23

EVENING SESSIONS

Boston Young Men's Christian Association
316 Huntington Avenue
Boston 17 :: Massachusetts

Northeastern University

Catalog of the Evening Polytechnic School

1922-1923

EVENING SESSIONS

Northeastern University of the Boston Y. M. C. A. is incorporated under the laws of Massachusetts and is located in Boston. Divisions of the University are conducted in Worcester, Springfield, Bridgeport, Providence and New Haven. Branches are conducted in Lynn, Malden and Newton

CALENDAR 1922-23

September 12
Registration Commences

September 18
Opening of First Term

October 12
Columbus Day (School exercises omitted)

November 30
Thanksgiving Day (School exercises omitted)

December 21
End of First Term

December 22—January 1, inclusive
Christmas Recess

January 2
Opening of Second Term

February 22
Washington's Birthday (School exercises omitted)

April 6
End of Second Term

April 7
Close of School

NORTHEASTERN UNIVERSITY

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Regional Director

IRA ARTHUR FLINNER, A.B., A.M.
Superintendent of Secondary Schools

FRED COLFAX SMITH, A.B., B.S.
Director of Vocational Institute

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HISTORICAL SKETCH

The incorporation of Northeastern University of the Boston Young Men's Christian Association in March, 1916, marked the culmination of a notable development. The University is not a new institution, but the realization of an ideal carefully worked out and persistently followed for a period of many years. The Boston Young Men's Christian Association, established in 1851, had as one of its first lines of endeavor, evening classes for young men.

It was not, however, until 1896 that the evening school system was placed upon a permanent basis with expert supervision. As courses were being offered in increasingly large numbers, it became evident that a more complete organization should be effected, with the result that the courses were grouped as separate schools, such additional courses being offered as would complete the curricula of the several schools. The School of Law established in 1898 was incorporated in 1904 with degree granting power. The School of Commerce and Finance founded in 1907 was incorporated in 1911, and was given the right to grant the Bachelor and Master of Commercial Science Degrees in the same year. The School of Engineering was opened in 1909, and received in 1920 the right to grant the following degrees: Bachelor of Civil Engineering, Bachelor of Mechanical Engineering, Bachelor of Electrical Engineering, and Bachelor of Chemical Engineering.

Affiliated with the University are the Evening Polytechnic School, the Huntington School for Boys, and the Northeastern Preparatory School. Divisions of the University have been established at Worcester, Springfield, Bridgeport, New Haven, and Providence, offering the complete courses of one or more of the following schools: School of Law, School of Commerce and Finance, or Evening Polytechnic School.

In order to more closely co-ordinate the work of the divisions and branches throughout New England with the work at Boston, a Regional Committee was organized May 5th, 1920, for the purpose of "promoting, financing, supervising, and developing Divisions and Branches of Northeastern University." This committee is organized so as to insure the most effective and uniform service to all.

The Evening Polytechnic School was founded in 1913. Although many evening technical courses had been offered before, the regular standard curriculums in Engineering consisting of three continuous years of study had not been established. The school now offers seven curriculums in Engineering in addition to special courses. The School is well equipped to carry on the Engineering work; has a faculty consisting of experienced and able engineers and educators; and an enrollment of three hundred students.

GENERAL INFORMATION

Many men in various lines of industry feel the need of special instruction in Engineering, either to advance in their normal occupation, or to enable them to change their positions and get into work of an Engineering nature.

To such men the School offers a wide variety of regular Engineering curriculums, and in addition, special instruction for those who desire it. The Engineering curriculums require attendance three evenings a week, during a period of three years. While only the fundamental subjects are taken up, the curriculums compare very favorably with similar curriculums offered by the good technical schools.

Three-Year Engineering Curriculums

Regular three-year curriculums, leading to a diploma, are offered in the following branches of Engineering:

I Civil Engineering
II Mechanical Engineering
III Electrical Engineering
IV Chemistry
V Structural Engineering
VI Industrial Engineering
VII Automotive Engineering

Special Courses

Special courses are offered by the School, and will be found described in detail in the latter part of this catalog.

Requirements for Admission

The work carried on in the regular curriculums assumes that the entering student has had previous training in Elementary Algebra to quadratics, Plane Geometry, and has a good ground-work in English. An entering student should have completed at least the equivalent of one or two years' work in a good high school. Those who have completed a full high-school course should be well fitted to carry on the courses and derive the maximum benefit from the work.

Men who have finished grammar school, but who have not had the requisite previous training in Mathematics and English, may attend the Evening Courses of the Northeastern Preparatory School, and should be able to get the necessary preparation for entrance to the Engineering School in one year.

There are no entrance examinations for entering students, but each applicant for admission is required to have an interview with the school officials.

The qualifications of each applicant will be ascertained and he will be advised as to just what work he is qualified to undertake.

Should a student prove to be unable to carry on his studies successfully, he may be required to discontinue any subject in which he is deficient, and complete such preparatory work as is deemed necessary, before being re-admitted to the subject in question.

Condition Examinations

Special condition examinations in any subjects which students have taken and failed will be given by the school during the week of April 9. All students who desire to take condition examinations are requested to file a petition at the school office on or before April 1st, in order that arrangements for the examinations may be made. Each student taking a special condition examination is required to have made a payment of $2.00 for the examination and to present his receipt as a card of admission to the examination.

Tuition Fees

For each year of the regular three-year curriculums, the tuition fee is sixty dollars. The tuition fee includes membership in the Association, and is payable as follows:

One-half upon entering the school
One-fourth November 14
One-fourth January 15

The tuition fee for special courses will be found on page 36.

Refunds

Inasmuch as the University assumes the obligation of carrying the student throughout the year, when the student registers, and the instruction and accommodations are provided on a yearly basis, the Committee on Refunds has ruled as follows:

A. Credits or refunds may be granted only as stated below:

1. Cash refunds may be granted only in cases where students are compelled to withdraw on account of personal illness. The application must be accompanied by a satisfactory certificate from a physician.

2. The unused portion of the tuition paid by the applicant may be placed in suspense and used at some future time by the applicant to apply upon tuition in any school in Northeastern University, provided it is used within two years. This action is taken provided the reasons as set forth in the application meet with the approval of the Committee on Refunds.

B. Applications for refunds must be presented within sixty days after withdrawal from school.

Laboratory Fees

All students taking courses in the Chemical and Electrical Laboratories are charged laboratory fees in accordance with the following rates: Inorganic Chemistry Laboratory (26), $5.00; Analytical Chemistry Laboratory (28), $10.00; Organic Chemistry Laboratory (30), $10.00; Direct Currents Laboratory (22), $5.00; Alternating Currents Laboratory (24), $5.00. These fees are payable on entrance and do not cover breakage or destruction of apparatus. They are non-returnable.

An additional chemical laboratory deposit of ten dollars must be made when a desk is assigned to a student. At the close of the school year the cost of equipment, broken by the student or not returnable, will be deducted from this amount and the balance refunded. Students failing to check up their desks upon leaving school will be charged one dollar extra.

Transfers

No student is permitted to transfer from one course to another without consulting the school officials beforehand and receiving a transfer order.

Rules of Standing in Scholarship

A student's grade is officially recorded by letters and percentages, as follows:

A, excellent, 90–100 per cent.
B, good, 80–89 per cent.
C, fair, 70–79 per cent.
D, passable, 60–69 per cent.
F, work incomplete or unsatisfactory, 40–59 per cent.
FF, complete failure, below 40 per cent.

A mark of F in any particular subject entitles the student to make up the unsatisfactory work, or to take a condition examination. This letter is given for all grades below 60 per cent on intermediate reports.

A mark of FF denies the privilege of taking a condition examination. The whole course must be repeated in class.

Reports of Standing

An informal report of the students' standing is issued at the end of the first term, and a formal report, covering the year's work, is issued at the close of each year.

Positions Held by Graduates

The graduates of the School are in constant demand, and it may be said that those who complete one of the courses successfully can be sure of desirable employment in their chosen lines.

Naturally the School does not guarantee to place its graduates in positions. This is not necessary since our graduates have no difficulty in finding places for themselves.

Special Students

A special student may take any subject, upon the approval of the Dean, provided he has had the necessary preliminary training.

Diplomas

Upon the satisfactory completion of any of the regular curriculums, the student is entitled to receive a diploma. A fee of ten dollars is required of all candidates for a diploma. This fee must be paid on or before March 1.

CURRICULUMS OF STUDY

GENERAL STATEMENT

The schedules of the various curriculums are given on the following pages. The first-year work of all curriculums is practically the same, with a few exceptions, which are made because of the need of the student for elementary training in his professional subjects.

The school year comprises twenty-eight weeks of class work and examinations. The twenty-eight weeks are divided into two terms of fourteen weeks each. The subjects in the Curriculum Outlines on the following pages have been arranged by terms. Opposite these subjects will be found the number of periods of sixty minutes each of class, recitation, laboratory or the drawing room work. The number in parenthesis, following the subject, is the number by which that subject is identified in the descriptive matter under "Subjects of Instruction."

When a student elects a curriculum, he is required to complete all subjects in that curriculum in order to receive a diploma. No subject is to be dropped, or omitted, without the consent of the Dean.

I. CIVIL ENGINEERING

The purpose of this curriculum is to give the student an education in those subjects which form the basis of all branches of technical education, and a special training in those subjects comprised under the term "Civil Engineering." It is designed to give the student sound training, both theoretical and practical, in the sciences upon which professional practice is based.

Civil Engineering covers such a broad field that no one can become expert in its whole extent. It includes Topographical Engineering, Municipal Engineering and Railroad Engineering. It covers land surveying, the construction of sewers, waterworks, roads and streets. All these branches of Engineering rest, however, upon a relatively compact body of principles, and in these principles the students are trained by practice in the class room, drawing room and the field.

The curriculum is designed to prepare the young engineer to take up the work of assisting in the location and construction of steam and electric railways, sewerage and water supply systems, etc.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Mathematics (1)	2	Trigonometry (2)	2
Practical Physics (5)	2	Practical Physics (5)	2
Mechanical Drawing (6)	2	Mechanical Drawing (6)	2

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (3)	2	Calculus (4)	2
Surveying (7)	2	Surveying (7)	2
Topographical Drawing (8)	2	Highway Engineering (9)	2

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Applied Mechanics (12)	2	Strength of Materials I (13)	2
Railroad Engineering (10)	2	Railroad Engineering (10)	2
Railroad Engineering Drawing (11)	2	Railroad Engineering Drawing (11)	2

II. MECHANICAL ENGINEERING

This curriculum is designed to give a foundation in those fundamental subjects which form the basis for all professional engineering practice, and especially to equip the young engineer with a knowledge of the various phases of Mechanical Engineering. The course embraces instruction by textbook, lecture, and drawing room.

The curriculum affords training in the methods, and gives practice in the process of Construction, which develops in the student the capacity for thinking along mechanical lines, thus enabling him to base all his work upon fundamental principles already learned, rather than upon empirical rules. It gives the student a good theoretical training and meanwhile devotes sufficient time to the practical work, so that he may become a proficient engineer, both in theory and in practice, in the various branches of Mechanical Engineering.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Mathematics (1)	2	Trigonometry (2)	2
Practical Physics (5)	2	Practical Physics (5)	2
Mechanical Drawing (6)	2	Mechanical Drawing (6)	2

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (3)	2	Calculus (4)	2
Engineering Drawing (18)	2	Engineering Drawing (18)	2
Applied Mechanics (12)	2	Strength of Materials I (13)	2

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Heat Engineering (20)	2	Heat Engineering (20)	2
Machine Design (19)	2	Machine Design (19)	2
Strength of Materials II (14)	2	Power Appliances (34)	2

III. ELECTRICAL ENGINEERING

The applications of electricity have developed rapidly in recent years, and students are required to have a good working knowledge of Mathematics and Physics. It is essential that students planning to take this course should realize the fundamental necessity of obtaining a solid grounding in these subjects.

It is not the purpose of the curriculum to attempt the impossible, to turn out fully trained engineers in the various branches of the science, especially as the electrical engineering field is becoming daily more and more differentiated and specialized. The course is designed rather to lay a thorough foundation for future progress along the lines of work which may particularly appeal to the individual, and give him a good working acquaintance with the essential principles which underlie each of the more specialized branches of professional activity. Parallel with the theoretical work runs a carefully planned course of laboratory work which is intended to develop the student's powers of planning work for himself.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Mathematics (1)	2	Trigonometry (2)	2
Practical Physics (5)	2	Practical Physics (5)	2
Mechanical Drawing (6)	2	Mechanical Drawing (6)	2

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (3)	2	Calculus (4)	2
Direct Currents, Lecture (21)	2	Direct Currents, Lecture (21)	2
Direct Currents, Laboratory (22)	2	Direct Currents, Laboratory (22)	2

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Alternating Currents, Lectures (23)	2	Alternating Currents, Lectures (23)	2
Alternating Currents, Laboratory (24)	2	Alternating Currents, Laboratory (24)	2
Heat Engineering (20)	2	Heat Engineering (20)	2

IV. CHEMISTRY

The growth of chemical industries in this country during the last few years has created a new interest in the science of chemistry and an active demand in widely different fields for graduates with a thorough training. The most potent reason for this is found in the replacement of the old rule-of-thumb methods with scientific methods.

This course provides the fundamental training in Inorganic, Analytical, and Organic Chemistry, both in the classroom and laboratory, on which all industrial practice rests, and aims to prepare its graduates to take a responsible part in the establishment or development of industries which involve an application of chemical principles.

Supplementing the lectures are well-planned laboratory courses designed to strengthen and broaden the student's knowledge which he has acquired in the lectures, and to foster a spirit to attack untried problems systematically, and especially to develop power on the part of the student.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Mathematics (1)	2	Trigonometry (2)	2
Inorganic Chemistry, Lectures (25)	2	Inorganic Chemistry, Lectures (25)	2
Inorganic Chemistry, Laboratory (26)	2	Inorganic Chemistry, Laboratory (26)	2

*** SECOND YEAR**

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Chemistry, Lectures (27)	2	Analytical Chemistry, Lectures (27)	2
Analytical Chemistry, Laboratory (28)	4	Analytical Chemistry, Laboratory (28)	4

*** THIRD YEAR**

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Organic Chemistry, Lectures (29).	2	Organic Chemistry, Lectures (29).	2
Organic Chemistry, Laboratory (30)	4	Organic Chemistry, Laboratory (30)	4

* The work of the second and third years is alternated each year. All second and third year students will take the third year work during the year 1922–1923 and then the second year work during 1923-1924.

V. STRUCTURAL ENGINEERING

The purpose of this curriculum is to give the student a special training in those subjects comprised under the term "Structural Engineering." It is designed to give the student sound and thorough training in the science upon which professional practice is based.

Structural Engineering covers such a broad field that no one can become expert in its whole extent. It includes the design and construction of girders, columns, roofs, trusses, arches, bridges, buildings, walks, dams, foundations and all fixed structures and movable bridges. It includes a knowledge of the relative merits of the design and construction of buildings, bridges, and structures composed of different materials used by the engineer, such as concrete, reinforced concrete, timber, cast iron, and steel.

The curriculum is designed to prepare the young engineer to take up the work of assisting in the design and construction of structures; to undertake intelligently supervision of erection work in the field; and general contracting.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Mathematics (1)	2	Trigonometry (2)	2
Practical Physics (5)	2	Practical Physics (5)	2
Mechanical Drawing (6)	2	Mechanical Drawing (6)	2

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Analytical Geometry (3)	2	Calculus (4)	2
Applied Mechanics (12)	2	Strength of Materials I (13)	2
Structural Drawing (15)	2	Structural Drawing (15)	2

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Concrete Construction (41)	2	Concrete Construction (41)	2
Theory of Structures (16)	2	Theory of Structures (16)	2
Structural Design (17)	2	Structural Design (17)	2

VI. INDUSTRIAL ENGINEERING

New England is a great industrial section. The leaders of industry are confronted with numerous industrial Engineering problems. The financial problems involve capitalization and dividends, as the making of money is the object of operating the factory. The physical problems involve the selection of a site for the factory, the source of power, the layout and arrangement of departments, machinery, and storage spaces.

The administration of the factory means the purchase of raw materials, the employing of labor, the actual production of the goods, the office and clerical work, and the marketing of the product.

The training outlined below provides the student with definite knowledge of the interrelations of all the departments of the factory, but is particularly a preparation for the technical positions which occur in many departments of the modern manufacturing plant.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Mathematics (1)	2	Trigonometry (2)	2
Practical Physics (5)	2	Practical Physics (5)	2
Mechanical Drawing (6)	2	Mechanical Drawing (6)	2

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
†Industrial Organization (35)	2	†Industrial Organization (35)	2
Analytical Geometry (3)	2	Calculus (4)	2
Engineering Drawing (18)	2	Engineering Drawing (18)	2

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
†Scientific Management (36)	2	†Traffic Management (37)	2
Applied Mechanics (12)	2	Strength of Materials I (13)	2
Production Engineering (33)	2	Power Appliances (34)	2

† These subjects in the second and third years are alternated each year. All second and third year students will take the third year work during the year 1922-1923 and then the second year work during 1923-1924.

VII. AUTOMOTIVE ENGINEERING

The extraordinary increase in the use of automobiles during the past few years has created a new profession. Automotive Engineering, which, in the opinion of automobile men, is absolutely necessary to the further development of the industry.

This three-year curriculum of study embraces the entire science of the automobile. Proper emphasis is placed on the design and construction of the automobile parts, body, symmetry, upkeep and repair, and management of production factories.

Such a complete curriculum as this is made possible through the co-operation of the Automotive School with the Evening Polytechnic School in furnishing laboratory facilities.

FIRST YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
Mathematics (1)	2	Trigonometry (2)	2
Practical Physics (5)	2	Practical Physics (5)	2
Mechanical Drawing (6)	2	Mechanical Drawing (6)	2

SECOND YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
†Industrial Organization	2	†Industrial Organization	2
Analytical Geometry	2	Calculus	2
*Motor Car Construction	2	**Motor Laboratory	2

THIRD YEAR

FIRST TERM	Periods per week	SECOND TERM	Periods per week
†Scientific Management (36)	2	†Traffic Management (37)	2
Applied Mechanics (12)	2	Strength of Materials I (13)	2
Production Engineering (33)	2	Power Appliances (34)	2

* Sixteen consecutive exercises beginning Tuesday, September 19, 1922.

**Sixteen consecutive exercises beginning Tuesday, January 9, 1923.

† These subjects in the second and third years are alternated each year. All second and third year students will take the third year work during the year 1922-1923 and then the second year work during 1923-1924.

SUBJECTS OF INSTRUCTION

Instruction is given by lectures and recitations, and by practical exercises in the field, the laboratories, and the drawing rooms. A great value is set upon the educational effect of these exercises, and they form the foundation of each of the courses. Text-books are used in many subjects, but not in all. In many branches the instruction given differs widely from available text-books, and in most of such cases, notes on the lectures and laboratory work are furnished to the students. Besides oral examinations in connection with the ordinary exercises, written examinations are held from time to time.

In the following pages will be found a detailed statement of the scope of the subjects offered in the various courses. The subjects are classified, as far as possible, related studies being arranged in sequence.

The subjects are numbered, or numbered and lettered, for convenience of reference in consulting the various curriculum Schedules.

The requisites for preparation include not only the subjects specified by number, but also those required as a preparation for them. The reason for this is that to carry on properly the more advanced subjects, the student must have become proficient in all the elementary subjects. Some studies, specified as being required in preparation, may be taken simultaneously. The student must complete such subjects before starting on more advanced work.

By careful consideration of the curriculum Schedules, in connection with the following Description of Subjects, the applicant for a special course may select, for the earlier part of that course, such subjects as will enable him to pursue later those more advanced subjects which he may particularly desire.

The topics included in the list which follows are subject to change at any time by action of the School authorities.

SYNOPSIS OF SUBJECTS

Regular Courses

1. Mathematics

Preparation: Elementary Algebra and Elementary Plane Geometry

This course is taken by all regular students during the first year, and consists of a general review of algebra up to quadratic equations, and a study of quadratic equations, ratio and proportion, variation, and the use of formulas, with special applications to problems in Physics and Engineering. It also covers a rapid review of the useful theorems of Plane Geometry with special reference to mensuration.

2. Trigonometry
Preparation: 1

This course consists of lectures and recitations covering logarithms, radians, co-ordinates, trigonometric ratios, formulas, law of sines, law of cosines, law of tangents, solution of right and oblique triangles with applications to problems in engineering. Instruction is also given in the theory and use of the slide rule.

3. Analytical Geometry
Preparation: 2

In this course instruction is given by lectures and recitations in the following subjects: Plotting of functions, interpolation, the straight line, the conic sections, curves represented by various equations of common occurrence in engineering, graphic solution of equations, determination of laws from the data of experiments, simplification of formulas.

4. Calculus
Preparation: 2 and 3

This course is taken by all regular engineering students during the second term of the second year. Instruction is given by lectures and recitations in the following subjects: rate of change, differentiation, maximum and minimum, integration, definite integrals, with application to the determination of mean value, area, volume, center of gravity and moment of inertia.

5. Practical Physics
Preparation: 1

This course consists of one lecture and one problem period each week throughout the first year. Instruction is given in the practical application of the laws of Physics. Each lecture is accompanied, as far as possible, by lecture table experiments on large-sized apparatus, built especially for this course so that the student may actually see a demonstration of the truth of the various laws, thus enabling him to grasp more readily the underlying principles. This course includes the study of the mechanics of solids, liquids, and gases, heat and its effects, and the principles of light and sound. Practical problems covering each phase of the work are given throughout the year, which are designed to fix in the student's mind the principles taken up in the lectures. The problem period gives the student a more thorough understanding of the application of the principles discussed in the lectures by the solution of practical problems.

6. Mechanical Drawing

The course is planned to meet the requirements of a class composed of students who have had no previous instruction in drafting and also for those who may have had one or two years' work in preparatory schools.

Instruction is given in the proper care and use of drawing instruments, T square, and triangles, and about twenty drawings are made, including geometrical constructions, orthographic and isometric projections, development, dimensioning, and lettering, thus giving the student a thorough training in the fundamental principles of mechanical drawing so that he may easily do the drafting required in his professional course.

Few formal lectures are given since the class room work is almost entirely individual, permitting student to progress at a rate commensurate with his own ability.

7. Surveying
Preparation: 2

This course is devoted to the study of surveying instruments, the methods of making surveys, the methods of plotting surveys as completed maps, and the solution of problems in plane surveying. Also, a study of the theory of geodetic surveying, solar and stellar observations, and the adjustments of instruments. Emphasis is laid on field note-keeping and on the construction and use of various plans with which the surveyor should be familiar.

8. Topographical Drawing
Preparation: 6

The first half of the course is devoted to a study of the various conventional symbols used in the drawing of topographical maps. Each student is required to familiarize himself with these symbols and make an inked drawing containing several of them. Reasonable proficiency in the use and application to maps is expected. The latter part of the course is given over to the making of a contour map from field notes, then applying typical problems of earthwork, such as figuring volumes, balancing cuts and fills, grading, etc.

9. Highway Engineering
Preparation: 7

The course is outlined to give the student the principles and practice of modern highway engineering. This is not entirely a lecture course, for much time is given to the discussion of the relative merits of numerous phases of the subject. The first part of the course considers the preliminary investigation, design, drainage, foundations, and layout, for gravel, earth and broken stone roads, including the use of bituminous materials. The latter part of the course considers several classes of pavements, including bituminous concrete, bituminous gravel, and macadam, asphalt, wood-block, stone block, concrete, and brick. Some time is devoted to studying sidewalks, curbs, bridges, culverts, and pipe systems.

10. Railroad Engineering
Preparation: 7

This course consists of instruction in the computation and methods of laying out simple, compound, reverse, vertical and easement curves; frogs, switches, and turnouts; the computation of earthwork from cross-section notes; setting slope-stakes and general consideration of more advanced problems of Railroad Engineering. Special emphasis is laid on field-notes and field methods.

11. Railroad Engineering Drawing
Preparation: 6, 10

The first term is devoted to the construction of a plan and a profile of a preliminary survey for a railroad. This is made from field notes of an actual survey and each student decides on his own location by the aid of a mass diagram. Comparisons are made as to the total cost of each student's location. The second term is devoted to the design and layout of a typical railroad yard as located at the end of a division. This includes the design of reversed curves, ladder tracks and the proper entrance to an engine round house. The course is supplemented by lectures.

12. Applied Mechanics
Preparation: 2, 5

A course of lectures and recitations comprising a study of the general methods and application of statics to structures in equilibrium, including the determination of reactions, also center of gravity, moment of inertia and radius of gyration of plane areas and solids. Problems are given illustrating the various principles of design.

13. Strength of Materials I
Preparation: 12

This course comprises the study of the strength of structural shapes in tension, compression, and bending. The subjects stated are the stresses and strains in bodies subjected to tension, compression and shearing; common theory of beams with thorough description of the distribution of stresses, shearing forces, and bending moments; longitudinal shear; slope and deflection; also the design of riveted joints and the stresses in simple frames subjected to external forces.

14. Strength of Materials II
Preparation: 13

This is a continuation of Strength of Materials I in which a study is made of the strength of shafting and springs; combined stresses in beams subjected to tension, compression, bending and torsion; also of the strength of hooks, columns and thin hollow cylinders, and brief consideration of strains and the relation of the stresses on different planes in a body. Kinematics and dynamics are also taken up,

including the uniform and varying rectilinear motion, centrifugal force, work, power and kinetic energy.

The methods of testing and the strength of various materials used by the engineer is also taken up in this course. The methods of manufacturing, properties and uses, of materials used in mechanical engineering work, such as iron, steel, and concrete are carefully studied.

15. Structural Drawing
Preparation: 6, 12

The course in structural drawing consists in the working out of various graphical problems of mechanics on the drawing board, drawing standard sections of structural steel shapes, structural details and the preparation of drawings, representing simple structures. The purpose of this course is to familiarize the student with detailed drawings and teach him where and how to dimension structural parts on working drawings.

16. Theory of Structures
Preparation: 14

This course consists of lectures, recitations and solution of problems. Instruction is given in the fundamental theory of structures, including the theory of beams, trusses, computation of reactions, moments and shears for static and moving loads by the use of shear diagrams, moment diagrams and influence lines. The work in the classroom is supplemented by the solution of practical problems in structural design.

17. Structural Design
Preparation: 15, 16

The course in structural design consists of work in the drawing room. It is a continuation of the course in structural drawing given in the second year, and includes the execution of elementary structural design, taking up in a practical way the principles of the course in Theory of Structures. Each student is given data for various problems, the designs for which he works out in the drawing room, making all necessary computations and executing all drawings necessary for the preparation of complete designs of a number of engineering structures.

18. Engineering Drawing
Preparation: 6

This course is a continuation of Mechanical Drawing, and includes the assembly of detailed drawings and detailing of assembled drawings of machines and machine parts. The principles of Mechanism are studied. The problem work takes up the design of pulleys, bolts, belts, gearing, and gear teeth development, cams and quick return motions used in machine tool such as shapers, slotters, and planers.

19. Machine Design
Preparation: 14, 18

This course aims to give the student practice in the application of theoretical principles previously studied and at the same time acquaint him with the many practical details which must be considered in design work. The problems taken up in the early part of the course are of a static nature, while the later problems involve dynamical stresses. The problems of the course vary from year to year, but the following are typical of the designs taken up; arbor press, hydraulic flanging, clamp, crane, air compressor, punch and shear, stone-crusher, etc.

In each design the constructive details are carefully considered with special attention to methods of manufacture, provision for wear, lubrication, etc. The work is based on rational rather than on empirical methods, the student being required to make all calculations for determining the sizes of the various parts and all necessary working drawings.

20. Heat Engineering
Preparation: 4, 5

A course in perfect gases and steam including the solutions of general problems and the use of steam and entropy tables. The work covers air compressors, refrigeration, gas engines, steam engines, turbines, and the equipment of a power house, boilers, condensers, and auxiliaries.

21. Direct Currents, Lectures
Preparation: 5

A course of lectures, recitations, and problem work during the second year, dealing with the fundamental laws and properties of electric and magnetic circuits. The course is devoted to the study of the principles of direct-current machinery.

22. Direct Currents, Laboratory
Preparation: 21 (taken concurrently)

This course is not to be taken by a student who is not at the same time taking (or who has not previously taken) Course 30; unless the student desiring to take it passes satisfactorily an examination upon the entire subject matter of the preparatory course.

The experiments given herein are intended to supplement and illustrate that course as well as give the students an understanding of the principal methods of electrical testing. Each student is required to furnish a complete report, including theory, method of procedure, numerical results and conclusions drawn, for each experiment he performs.

The work in the Laboratory will not begin until after about eight of the lectures in Course 30 have been completed, or until the instructor

in that course feels satisfied that sufficient theoretical progress has been made for the student to handle the Laboratory apparatus and circuits with safety and use them intelligently.

23. Alternating Currents, Lectures
Preparation: 21

A course of lectures, recitations and problem work during the third year, dealing with the principles of electromagnetism, electrostatics, variable currents, and harmonic currents, including both single-phase and polyphase circuits. A detailed study is made of the construction, theory and application of alternating-current machines.

24. Alternating Currents, Laboratory
Preparation: 22 and 23 (taken concurrently)

This course is taken in connection with the corresponding class room work in alternating currents, and the experiments performed are related to that work.

Since the work is considerably more complex and difficult it is even more necessary that the student have adequate preparation, and he must either take Course 32 concurrently (or have already taken it), or pass a satisfactory examination upon the entire subject matter.

The Laboratory instruction will begin after five of the lectures in Course 32 have been covered.

25. Inorganic Chemistry

A course of experimental lectures on the fundamental laws and principles of inorganic chemistry. Emphasis is placed on the study of elements, compounds, and theories, which form a basis for more advanced courses in chemistry. Problems of a physio-chemical chemical nature involving the gas laws; application of Avogadro's hypothesis; the law of definite proportion; electrolytic dissociation and the law of mass action are assigned and discussed in class. Important physical principles including a study of the mechanics of solids, liquids, and gases, heat and its effects; and elementary electricity, are also given consideration.

26. Inorganic Chemistry, Laboratory.
Preparation: 25

By performing a number of selective experiments it is desired to develop a spirit of initiative, self-reliance, and research, on the part of the student. It is important that the student performing the experiment observe what happens; consider why it happens; and predict the action of similar substances. The laboratory course is run in conjunction with the lectures, and experiments which verify principles discussed in class are included. By the preparation of elements and compounds such as oxygen, hydrogen, the halogens, hydrochloric

acid, copper sulphate, etc., it is hoped to cultivate a scientific attitude and habit of thought on the part of the student. Neat and satisfactory notes are considered an essential part of the course.

27. Analytical Chemistry, Lectures

Preparation: 25

This course takes up the rudiments of qualitative and quantitative analysis. In qualitative analysis not only the procedures used in the detection of the common elements are studied, but also the general principles involved, including hydrolysis, solubility product, amphoteric electrolytes, laws of solutions, and the general facts of inorganic chemistry. In quantitative analysis, half of the time is devoted to gravimetric analysis, including chloride, sulphate, and phosphate determinations. The other half of the time is devoted to volumetric analysis as illustrated by acid and alkali determinations, oxidation methods involving bichromate, permanganate, and iodine solutions, and the methods of volumetric precipitation. Special attention is given to the solution of numerical analytical problems of a practical nature.

28. Analytical Chemistry, Laboratory

Preparation: 27

The qualitative laboratory course consists of a series of preliminary experiments illustrating principles and giving an opportunity for practice in writing equations. The analysis of unknown substances is undertaken, beginning with solutions and simple salts, and later analyzing minerals, pigments, slags, alloys, and various commercial products, such as boiler compounds, cleaning powders, glass enamels, and similar inorganic compounds. The course in quantitative analysis includes the calibration of burettes, the use of analytical balances, and a limited number of typical gravimetric and volumetric analyses in which great stress is laid on the accuracy, care, and integrity necessary for successful quantitative work.

29. Organic Chemistry

Preparation: 27, 28

This course is devoted to lectures in the general principles and theories of organic chemistry, the methods of preparation and the characteristic reactions.

The student who is planning to fit himself for a life work in chemistry should take up organic chemistry in the spirit of respect of the magnitude and complexity of the subject. He must go through the difficulties and not over or around them. The subject is presented in a sufficiently elementary manner so as not to be beyond the grasp of the student in his first course in organic chemistry, yet comprehensive

enough in that it covers the entire field by taking up practically all of the important groups of compounds.

Emphasis is placed on the study of unsaturation, the influence of structure and substituents on the activity of the radicals.

30. Organic Chemistry, Laboratory
Preparation: 29

This course includes two kinds of laboratory practice: (*a*) Organic preparations. In this the student becomes familiar with the more common methods of manipulation and the more important synthetic processes, while the application of theory to the work in hand is constantly emphasized by regular conferences with individual students.

(*b*) Identification of Pure Organic Compounds. This part of the work has a similar educational value to that afforded by Qualitative Analyses in the inorganic field, and the student is expected to overcome all sources of error so as to acquire confidence in his results.

31. Motor Car Construction

A lecture course of sixteen consecutive lectures given in co-operation with the Automotive School. This course covers the essentials of Automobile Maintenance and repair, including ignition, starting and lighting, carburetion, cooling and oiling systems, tire work, transmissions, and differentials.

32. Motor Laboratory
Preparation: 31

This course contains sixteen consecutive shop exercises in general repairing, overhauling, replacing of parts, and common adjusting; beginning Tuesday, January 10, 1922, and continuing beyond the regular closing period of the school in April.

33. Production Engineering

A descriptive course intended to acquaint the student with the organization, methods, and equipment used in industrial plants engaged in quantity production. For purposes of discussion the plant is divided into its various units: such as general offices, drafting-room, pattern-shop, foundry, machine-shop, erecting shop, testing room, etc. The mechanical equipment, filing systems, cost-keeping systems, "follow-up" cards, etc., are described, and representative examples are shown.

34. Power Applications

The course in Power Applications is devoted largely to a description of the many appliances used in modern power plants and in manufacturing establishments. A study is made of boilers, boiler accessories, electrical motors and generators and various types of gas engines. The aim of the course is to familiarize the student with the various

kinds of appliances for using power that he may be able clearly to determine the advantages or disadvantages of using certain appliances in any given case.

35. Industrial Organization

A general introduction to the scientific method and spirit of modern industry. The forms of organization, whether partnership or corporation, are described. Some attention is paid to banking, exchange, and a few principles of accounting. The topics considered include office management, purchasing, selling, and advertising.

36. Scientific Management

The system of drafting room, pattern shop, foundry, and machine shop is taken up in detail, although many of the principles developed apply to any line of business. An analysis of production control, time, and motion study and cost problems is included.

37. Traffic Management

This covers the shipping of the product after the manufacturing is complete, including the range of usefulness of the motor truck, and the classification of the freight rates on the railroads.

38. Architectural Drawing I

An elementary course, including the fundamental principles underlying all kinds of mechanical and architectural drawing; geometrical problems; orthographic and isometric projections; classical moldings; Roman alphabet and roof problems.

In connection with this course the instructor will outline a course of reading in architectural history.

39. Architectural Drawing II
Preparation: 38

The orders of Architecture. Practical architecture and details of construction. In this course the student is taught the component parts of buildings. Typical details of construction are drawn to a large scale and in isometric projection.

40. Architectural Drawing III
Preparation: 39

This course covers the making of complete plans, elevations and working drawings of some elementary problem.

41. Concrete Construction

A course in the theory and practice of concrete construction. It includes the design of buildings, bridges, and various types of plain and re-inforced concrete structures.

An especially prepared text has been written for this course, in order to meet the demands of men who have not had the advantages of an ideal preparation. This text will be supplemented by lectures, slides, and inspection trips of actual work.

ENGINEERING EQUIPMENT

The Schools in Boston and the Divisions are housed in buildings of the Association. In Boston the School also occupies the Gainsborough Building and the Vocational Building.

The equipment available for the use of the School includes:

36 Class Rooms
5 Drawing Rooms
3 Chemical Laboratories
1 Electrical Engineering Laboratory
1 Electrical Measurements Laboratory
1 Mechanical Engineering Laboratory
2 Physics Laboratories
Civil Engineering Equipment
2 Libraries
3 Social Rooms
3 Game Rooms
3 Gymnasiums
1 Swimming Pool
2 Large Halls
8 Offices and Equipment

Mechanical Laboratories

The steam power plant is completely equipped with meters, scales, indicators, Orsat apparatus for flue gas analysis, and all other equipment necessary for making complete power plant tests. The plant consists of four horizontal-return tubular boilers, two of which are equipped for burning fuel oil and two for burning coal; and four three-wire generators, of which three are driven by Ridgway reciprocating steam engines of various sizes, and the other is connected direct to a Westinghouse-Parsons turbine. This places at the disposal of our classes a perfectly equipped, up-to-date, engineering laboratory, and gives them the means of carrying on boiler tests, determining the efficiencies of various fuels and oils, taking indicator diagrams, determining the efficiency of modern reciprocating engines and turbines when connected direct to generators.

The students have the use of the equipment of our Automobile School, and they thus have an opportunity to study the most advanced ideas in gasoline engine practice.

Field Instruments of Civil Engineering

For work in the field, the Civil Engineering Department possesses various surveying instruments, representing the principal makes and types in general use. The equipment includes two Keuffel & Esser transits, two Buff & Buff transits, two Berger levels, two other levels, and three plane table outfits. There are Locke hand levels, flag poles, leveling rods, stadia rods, engineers' and surveyors' chains, steel and cloth tapes, and all the miscellaneous equipment necessary to outfit the parties that the instruments will accommodate. The transits are equipped with neutral glasses and reflectors for astronomical observations. For higher surveying there is an aneroid barometer for barometric leveling, a sextant for hydrographic surveying, and a Gurley Electric Current meter for hydraulic measurements.

The extent of the equipment and the scope of field work itself are designed to train the student's judgment as to the relative merits of the various types of field instruments.

Design and Drafting Rooms

The School possesses large, light, and well-equipped drawing rooms for the carrying on of the designing and drafting which form so important a part of engineering work. These rooms are supplied with lockers containing the drawing supplies, and files containing blue prints and photographs of machines and structures that represent the best practice.

Electrical Measurements Laboratory

The laboratory was entirely rebuilt during the summer of 1920. It is equipped with apparatus fundamentally planned for teaching the principles of measurement, rather than for the precise determination of quantitative results. Nevertheless it is necessary for the proper performance of work in the other laboratory courses that a certain amount of careful quantitative work should be done, and the equipment is being steadily increased and developed with both ends held in view.

A partial list of the apparatus available for instruction is the following. Under the first head, resistance by Ohm's law, substitution and direct reflection, voltmeter methods for high resistance, insulation resistance, specific resistance, slide wire bridge, electrostatic capacity, inductance, Poggendorf's method of E. M. F. comparison. Under the second head, a Laboratory standard Wheatstone Bridge, a Kelvin low resistance bridge, a Leeds Northrup potentiometer with two standard Weston cells, volt box and steady source of high voltage for voltmeter calibration, a commutator and leads for use with the Cary-Foster method, and a chemical balance.

The instrument room is supplied with 18 high-grade G. E. and Weston ammeters and voltmeters of various sizes for D. C. work, together with numerous similar instruments of cheaper quality for lower class work.

For A. C. testing, there are 27 voltmeters and ammeters of various sizes arranged in groups of three for polyphase work, and 8 single or 3 phase wattmeters.

There is also a considerable amount of auxiliary apparatus, such as frequency indicators, synchroscopes, and power factor meters.

Electrical Engineering Laboratory

The Laboratory was entirely remodeled during the summer of 1920. It is equipped with numerous machines of different types, the size and voltage ratings being selected to reduce as much as possible the risk

from large voltage and power apparatus, while at the same time making available to the student commercial apparatus such that the various quantities it is desired to measure will be of reasonable dimensions.

Moderate-sized machines are used principally for this reason but also because the students in their Engineering Practice come into contact with the large-sized and varied machinery of modern power houses and electrical plants generally.

Among the machines of this department are a pair of matched Holtzer-Cabot 5 kv-a synchronous converters, specially planned to operate as 3 phase generators, motors or double current generators. They are driven independently by 10 HP 220-volt General Electric interpole motors, and may also be mechanically coupled for certain work.

There is also a pair of matched and specially designed direct current generators of 6 kilowatt rating at 220 volts, which may be operated either shunt or compound, driven by a 15 kilowatt interpole Sprague motor with double extended shaft. These machines are particularly intended for work on characteristics and parallel operation, but may also be coupled so as to be available in the various "pumping back" methods of testing.

Alternating current is supplied by a three-phase General Electric 15 kv-a alternator, giving practically a pure sine wave, driven by a 20 kw Westinghouse motor; there is also a 7.5 kv-a General Electric alternator driven from a 15 HP Sprague motor, fitted with taps from each armature coil, a 5 kv-a Holtzer-Cabot machine with two spare rotors making it available either as a generator, synchronous motor, squirrel cage or phase wound induction motor; and a dozen or so more motors and generators of various sizes and types.

There are two sets of G. E. type H transformers, three to the set, of 3 kv-a rating with primary voltage of 550 and secondary of 220-110, which may be used for transmission experiments as well as ordinary testing, and a very considerable assortment of variable ratio transformers, reactances, condensers, and similar control and testing apparatus, aside from the very complete line of instruments belonging to the Electrical Measurements Laboratory.

Physics Laboratories

The Physics department has been completely equipped with all necessary apparatus for the experimental work that is required of the students, as well as that required for lecture demonstration. There are two large laboratories together with a lecture room devoted to Physics. The apparatus and equipment includes verniers, levels, a vacuum pump, planimeters, spherometers, calorimeters, thermometers, a pyrometer, a sonometer, a spectroscope, a spectrometer, balances, standard gram weight, lecture table galvanometer, optical disk with all accessories, lenses, photometer, an air thermometer, a

full set of Weather Bureau apparatus, including a barograph, thermograph, hygrometer, barometer, maximum and minimum thermometers, etc. These give a wide range to the experimental work that can be done.

Chemical Laboratories

The School has three laboratories completely equipped in all respects for carrying on all lines of chemical work, from that of a high school to that of most advanced college grade. There are accommodations for over one hundred and fifty students, and are suitably furnished with all the necessary appliances for chemical work. Some of these are hoods, drying closets, a still, steam and hot water baths, electrolytic circuits, vacuum and pressure apparatus, balances, combustion furnaces, and complete sets of apparatus for the sampling and analysis of flue gases and fuels. There are also testing machines for oils, viscosimeters, and different sorts of flash point apparatus. A chemical museum is connected with this department where are kept specimens for purposes of illustration.

Libraries

The School shares the privileges of the steadily growing Libraries in the Main Building, to which have been added more than a $1000 worth of engineering texts purchased for the School. In addition to this, it subscribes to current periodicals on engineering and scientific subjects for the exclusive use of students. All members of the School are entitled to take books from the Boston Public Library, and this offers a very unusual opportunity to the non-resident students.

Department of Physical Training

Northeastern is one of the universities having facilities for all-round physical training. Each building in which the School is conducted is equipped with unexcelled facilities for physical training. Students are urged to avail themselves of these privileges, which can be obtained for a small fee each year. It is vitally important that men who are employed during the day and studying at night take some form of bodily and recreational exercise in order that they may do the most effective school work.

COURSES OF STUDY

Schedule of Engineering Subjects

(Arranged alphabetically by subjects)

Subject Number	*Subject*	*Evenings*	*Time*
23	Alternating Currents, Lectures	Mon.	7:00–9:00
24	Alternating Currents, Laboratory	Wed.	7:00–9:00
27	Analytical Chemistry, Lectures	Mon.	7:00–9:00
28	Analytical Chemistry, Laboratory	Wed. and Thurs.	7:00–9:00
3	Analytical Geometry	Mon.	7:00–9:00
12	Applied Mechanics	Thurs.	7:00–9:00
38	Architectural Drawing I	Thurs.	7:00–9:00
39	Architectural Drawing II	Thurs.	7:00–9:00
40	Architectural Drawing III	Thurs.	7:00–9:00
4*	Calculus	Mon.	7:00–9:00
41	Concrete Construction	Wed.	7:00–9:00
21	Direct Currents, Lectures	Thurs.	7:00–9:00
22	Direct Currents, Laboratory	Wed.	7:00–9:00
18	Engineering Drawing	Tues.	7:00–9:00
20	Heat Engineering	Thurs.	7:00–9:00
9*	Highway Engineering	Wed.	7:00–9:00
35	Industrial Organization	Wed.	7:00–9:00
25	Inorganic Chemistry, Lectures	Mon. and Thurs.	8:00–9:00
26	Inorganic Chemistry, Laboratory	Wed.	7:00–9:00
19	Machine Design	Tues.	7:00–9:00
6	Mechanical Drawing	Wed.	7:00–9:00
1	Mathematics	Mon. and Thurs.	7:00–8:00
31	Motor Car Construction	Tues.	7:00–9:00
32*	Motor Laboratory	Tues.	7:00–9:00
29	Organic Chemistry, Lectures	Mon.	7:00–9:00
30	Organic Chemistry, Laboratory	Wed. and Thurs.	7:00–9:00
34*	Power Appliances	Mon.	7:00–9:00
5	Practical Physics	Mon. and Thurs.	8:00–9:00
33	Production Engineering	Mon.	7:00–9:00
10	Railroad Engineering	Mon.	7:00–9:00
11	Railroad Engineering Drawing	Wed.	7:00–9:00
36	Scientific Management	Wed.	7:00–9:00
13*	Strength of Materials I	Thurs.	7:00–9:00
14	Strength of Materials II	Mon.	7:00–9:00
17	Structural Design	Wed.	7:00–9:00
15	Structural Drawing	Wed.	7:00–9:00
7	Surveying	Thurs.	7:00–9:00
16	Theory of Structures	Mon.	7:00–9:00
8	Topographical Drawing	Wed.	7:00–9:00
37*	Traffic Management	Wed.	7:00–9:00
2*	Trigonometry	Mon. and Thurs.	7:00–8:00

* Second Term courses beginning January 2, 1923

RATES OF TUITION

Regular Three-Year Courses

Tuition fee for each year of the regular curriculums is sixty dollars, payable as follows:

One-half upon entering
One-fourth November 14
One-fourth January 15

The foregoing rates include membership in the Young Men's Christian Association.

Individual Engineering Subjects

(Arranged alphabetically by subjects)

	Course	*Number of Classes*	*Tuition*
23	Alternating Currents, Lectures	28	$20.00
24	Alternating Currents, Laboratory	28	20.00
27	Analytical Chemistry, Lectures	28	20.00
28	Analytical Chemistry, Laboratory	56	40.00
3	Analytical Geometry	14	10.00
12	Applied Mechanics	14	10.00
38	Architectural Drawing I	28	20.00
39	Architectural Drawing II	28	20.00
40	Architectural Drawing III	28	20.00
4	Calculus	14	10.00
41	Concrete Construction	28	20.00
21	Direct Currents, Lectures	28	20.00
22	Direct Currents, Laboratory	28	20.00
18	Engineering Drawing	28	20.00
20	Heat Engineering	28	20.00
9	Highway Engineering	14	10.00
35	Industrial Organization	28	20.00
25	Inorganic Chemistry, Lectures	56	20.00
26	Inorganic Chemistry, Laboratory	28	20.00
19	Machine Design	28	20.00
6	Mechanical Drawing	28	20.00
1	Mathematics	28	10.00
31	Motor Car Construction	16	10.00
32	Motor Laboratory	16	10.00
29	Organic Chemistry, Lectures	28	20.00
30	Organic Chemistry, Laboratory	56	40.00
34	Power Appliances	14	10.00
33	Production Engineering	14	10.00
5	Practical Physics	56	20.00
10	Railroad Engineering	28	20.00
11	Railroad Engineering Drawing	28	20.00
36	Scientific Management	14	10.00
13	Strength of Materials I	14	10.00
14	Strength of Materials II	14	10.00
17	Structural Design	28	20.00
15	Structural Drawing	28	20.00
7	Surveying	28	20.00
16	Theory of Structures	28	20.00
8	Topographical Drawing	14	10.00
37	Traffic Management	14	10.00
2	Trigonometry	28	10.00

The individual rates above are in addition to membership in the Y. M. C. A.

NORTHEASTERN UNIVERSITY

DAY SCHOOLS

SCHOOL OF ENGINEERING

Four-year courses in Civil, Mechanical, Electrical, Chemical, and Administrative Engineering, leading to the degrees of Bachelor of Civil, Mechanical, Electrical, and Chemical Engineering. Conducted in co-operation with engineering firms. Students earn while learning. Work conducted at Boston.

SCHOOL OF BUSINESS ADMINISTRATION

Four-year course in Business Administration leading to the degree of Bachelor of Commercial Science. Students may specialize in Industrial Management, Marketing, Finance, and Accounting. A two-year course leading to the Certificate of Proficiency. Work conducted at Boston.

EVENING SCHOOLS

SCHOOL OF LAW

(Co-Educational)

Four-year course leading to the degree of Bachelor of Laws. Preparation for Bar Examination and practice. High scholastic standards. A limited number of mature special students admitted each year. Work conducted at Boston, and in Divisions at Worcester, Springfield, and Providence.

SCHOOL OF COMMERCE AND FINANCE

(Co-Educational)

Four-year courses in Professional Accounting and Business Administration leading to the degrees of Bachelor and Master of Commercial Science. Special two-year courses for those desiring intensive specialization. Work conducted at Boston, and in the Divisions and Branches at Worcester, Springfield, Providence, Bridgeport, New Haven, Lynn, Malden, and Newton.

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Three-year courses in Civil, Mechanical, Electrical, Chemical, Structural, Industrial, and Automotive Engineering leading to a diploma. Work conducted at Boston. Trains men for positions of trust and responsibility.

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Courses in usual high school subjects leading to a diploma. Three sixteen-week terms each year. It is possible for students to meet college-entrance requirements in from three to five years. Work conducted at Boston and in Divisions at Worcester and New Haven.

VOCATIONAL INSTITUTE

A diversified program of short intensive courses including all phases of Automotive industry with special instruction for owners, salesmen, mechanics, and chauffeurs.

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Home Study courses in co-operation with the United Y. M. C. A. Schools. Classes organized and lectures conducted in cities and towns throughout New England, and in co-operation with leading corporations and business concerns.

For further information concerning any of the above schools

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